Docket No.: 21736-00012-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Lawrence M. Ausubel

Application No.: 09/397,008 Confirmation No.: 8229

Filed: September 15, 1999 Art Unit: 3628

For: ASCENDING BID AUCTION FOR MULTIPLE OBJECTS Examiner: F. Poinvil

APPEAL BRIEF

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This brief is filed more than two months after the Notice of Appeal filed in this case on February 7, 2007, and is in furtherance of said Notice of Appeal.

The fees required under § 41.20(b)(2) are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E.P. § 1205.2:

I.	Real Party In Interest
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I. REAL PARTY IN INTEREST

The Real Party In Interest in this appeal is the inventor, Lawrence Ausubel.

II. RELATED APPEALS AND INTERFERENCES

Appeal No. 2002-2245 (decided March 31, 2003 in Applicant's application SN 09/476877) is related to this Appeal. The application involved in that appeal was based on an invention which is subsequent to the present invention. In the decision the Board (p. 5) noted that

> "it is incumbent upon the examiner to establish a factual basis to support the legal conclusion of obviousness".

They continued by stating:

> the examiner is expected to make the factual determinations set forth in *Graham v. John Deere Co.* 383 US 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one having ordinary skill in the pertinent art would be led to ... combine the prior art references to arrive at the claimed invention. .... These showings by the examiner are an essential part of complying with the burden of presenting a *prima facie* case of obviousness."

A copy of that decision is attached in Appendix C.

III. STATUS OF CLAIMS

A. This application contains claims 26-30, 43-55, 58-61, 113-115, 126-133, 139-141 and 152-173.

B. Current Status of Claims

1. Claims 1-25, 31-42, 56-57, 62-112, 116-125, 134-138 and 142-151 have been cancelled.

2. There are no claims withdrawn from consideration but not cancelled.

3. The claims pending: 26-30, 43-55, 58-61, 113-115, 126-133, 139-141 and 152-173.

4. Claims allowed: none as reflected in the summary of the final rejection, however the final rejection states that claims 26, 28-30, 43, 45, 47-55, 58, 60, 113-115, 126-133, 139-141 and 152-159 are allowable (presumably claim 27, dependent on claim 26, is also allowable, since there is no rejection applied to claim 27).

5. Claims rejected: all pending claims (26-30, 43-55, 58-61, 113-115, 126-133, 139-141 and 152-173) as reflected in the summary of the final rejection, but the only rejection stated in the action is applied to claims 44, 46, 59, 61 and 160-173.

C. Claims on Appeal

The claims on appeal are claims to which the final rejection is applied, namely claims 44, 46, 59, 61 and 160-173.

IV. STATUS OF AMENDMENTS

No Amendments have been filed following the Final Rejection of October 20, 2006.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The claimed subject matter relates to improving auctions, particularly improving the efficiency of auctions.

Before describing the claimed subject matter a short note about auction types is worthwhile. The most well-known auction is the open-outcry ascending price auction. This type of auction is initiated (by the auctioneer) with an indication of what good (there is only one good or lot subject to auction) is the subject of the auction. At that point bidders simply indicate a price (bid) by open outcry. The auction continues so long as new (and increasing) bids are received. The auction terminates in the absence of an increased bid; the good is assigned to the last bidder. Although there are other formats, most ascending-bid auction formats (where there

may be multiple goods subject to the auction) have the unfortunate property that identical objects sell at the uniform price reached at the end of the auction. This does not generally lead to efficient outcomes. The invention relates to auctions which are more efficient than the auctions that have been described.

The improvements which are the subject of the claims are found in auctions which (1) deal with multiple objects or goods and (2) which have multiple bidding opportunities. In one form of this auction bidding occurs in rounds, the price increases as the rounds progress and a bid specifies the number of items or objects which are sought by the bidder. An auction in which the current price is announced to bidders (as opposed to the bidders themselves naming prices) and the price changes in sequential rounds is known as a clock auction, where the different states of the clock represent different prices. Typically at the start (because the price may be low) the total of the items bid for, as reflected in the bids, is much larger than the number of the objects or items actually available. The auction may conclude when the total of the number of the items or objects sought, as reflected in all the current bids, is no greater than the number of items or objects actually available (this is known as a closing rule in that it defines when the auction closes).

Two major features are found in the claims. Some of the claims describe an automated auction conducted in rounds allowing the same or similar articles to be assigned to bidders (i.e., sold) at different prices (independent claims 44, 46). Allowing assignment of the same or similar articles (specifically "identical objects, similar objects or close substitutes") at different prices (i.e., in different rounds) is implemented by making a determination at (or as of) an intermediate point in the auction. In other words objects or items are assigned before the auction terminates or at a price which had been applicable prior to termination of the auction[1]. Assigning an item at (or as of) an intermediate point in the auction allows the same or similar items to be assigned at different prices, usually the earlier the assignment (or effective assignment) the lower the price. The potential for early assignment (especially at a favorable price compared to the price that would be obtained at a later time in the auction) provides an incentive for a bidder to bid the true quantity that it values at a given price, as opposed to

[1] This is sometimes referred to as "clinching" - similar to the usage familiar to baseball fans with respect to "clinching" the pennant.

strategically reducing its demand. This incentive serves to improve auction efficiency. This subject matter is recited as determining separately for a plurality of bidders, a quantity of objects to be assigned "in a current round" and assigning "at the price for the round" (claims 44, 46, 59, 61). To emphasize the effect of the assignment the same claims also note that the "assigning indicating a winning bidder".

A second major feature found in some of the rejected claims (independent claims 160, 163, 167, 170) is constraining bids in a clock auction to insure that each bid includes a quantity which is no greater than a quantity found in an earlier bid. In other words the bidder cannot increase the quantity of articles or items from one bid to the next. The presence of the constraint also provides an incentive for a bidder to bid the true quantity that it values at a given price, as opposed to strategically reducing its demand, again improving the efficiency of auction. The same claims specify that a determination to close the auction is based on a relation between a sum of the quantities contained in all the bids and an available quantity of items.

Claim 44 also calls for "limiting the number of objects on which a bidder may bid to be no larger than a number of objects on which the bidder was allowed to bid in a preceding round".

Some of the claims (independent claims 160 and 167) also specify that a bid, indicating "a quantity of items", includes a "quantity parameter". This recitation is different from a bid indicating a quantity of items which are desired in that the desired quantity of items may be indicated in a number of ways. These claims, however, are specific that there is a "quantity parameter" in a bid.

Claims relying on 35 USC 112 6th paragraph

Claims 44, 46, 160 and 167 and their dependent claims are in apparatus form and include recitations provided for under 35 USC 112, sixth paragraph.

The specification describes that an auction is implemented by a computer, such as the Bidding Information Processor (BIP) 110 and a plurality of Bid Entry Terminals (BET) 120a-120n shown in figures 1a and 1b and described from page 8, line 1 through page 10, line 8.

Claims 44 and 46, in describing components of the bidding information processor, recite:

> "means for generating current bidding information including at least the current price associated with at least one object,
>
> means, coupled to the generating means, for transmitting a signal representing current bidding information from the bidding information processor to bid entry terminals".

Claims 44 and 46, in connection with the bidding information processor, also recite:

> "means for generating updated bidding information and initiating at least one more round of bidding if any objects remain unassigned".

Claims 167 and 170 recite:

> "transmitting means for transmitting a signal representing information regarding bidding, said information including at least an indicator of a current price",
>
> "generating means for generating updated information regarding the bidding process; and
>
> initiating means for initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue."

The specification describes fig. 2a which illustrates an initialization process (202) providing for information including an initial price (10:8-12). That information is transmitted to the terminals (204) as described (10:12-14). At the end of a round of bidding current price information is updated (216). The updated information is then transmitted to the terminals (204) as described (12:22-25).

Claims 44 and 46 recite:

> "means for receiving bids from bid entry terminals".

Claim 167 recites:

> "receiving means for receiving bids submitted by a plurality of bidders, each said bid indicating at least a quantity of the items that a bidder wishes to transact at the current time and at least one said bid including a quantity parameter indicating a quantity of the items that a bidder wishes to transact at the current time".

Claim 170 recites:

> "receiving means for receiving bids submitted by a plurality of bidders, each bid indicating at least a quantity of the items that a bidder wishes to transact at the current price".

Function 208, in fig. 2a effects the function to "receive bidding information" as is described in the specification (12:9-13). The bidding information may include "the quantity which the bidder demands in the current round" (12:8). That is the "quantity parameter".

Claim 44, in describing the bidding information processor, recites:

> "means for determining, separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round,
>
> means for assigning the determined quantity of objects to the determined bidder at the price for the round, said assigning indicating a winning bidder".

Functions 212-3-1 through 212-3-4 (fig. 2c) provide for the selection of a bidder. Once a bidder is identified it is possible to sum the quantities contained in the bids of other bidders, thereafter to determine whether this sum is less than the available number of objects and, finally if it is, assign an object or objects to the selected bidder at the current price (in particular those objects which the other bidders have not bid for). These functions are described in the specification (13:15-24). Function 212-3-1 is reached from function 212-3 (of fig. 2b). Function 212-3 follows from function 212-2 in the event the Y path is taken. Function 212-2 in turn is reached from function 212-1 which is reached from function 212 of fig. 2a. The fact that the assignment indicates a winning bidder is explained at 13:4-7, see also 4:19-26.

Claim 44 recites:

> "means for limiting the number of objects on which a bidder may bid to be no larger than a number of objects on which the bidder was allowed to bid in a preceding round".

Claim 167 recites:

> "constraining means for constraining bids so that the quantity contained in a bid at a current time can be no greater than the quantity contained in an earlier bid."

Claim 170 recites:

> "constraining means for constraining bids so that the quantity that the bidder wishes to transact at the current price can be no greater than the quantity that the bidder wished to transact at an immediately preceding price".

The specification describes the Bidding Information Processor and Bid Entry Terminals are data processors (4:11-15) and "The activity rule used in this example is that bidders are not allowed to increase their bids from round to round. Rather, each bidder is permitted to demand the same quantity as in the previous round of bidding or any lower quantity." (5:4-7).

Claim 167 recites:

> "summing means for summing the quantities that all bidders wish to transact at the current time to determine a summed quantity of items that bidders wish to transact at the current time;
>
> determining means for determining whether the auction should end or continue, based on a comparison of the summed quantity of items that bidders wish to transact at the current time and an available quantity of items".

Fig. 2b (described at 12:26-13:14) shows function 212-1 which sums the quantities that all bidders wish to transact at the current time to determine a summed quantity of items that bidders wish to transact at the current time. Function 212-1 determines whether the auction should end or continue, based on a comparison of the summed quantity of items that bidders wish to transact at the current time and an available quantity of items.

Claim 170 recites:

> "determining means for determining whether the auction should end or continue, based on a comparison of a sum of quantities that bidders wish to transact at the current price and an available quantity of items".

Claim 170 continues by reciting that the determining means comprises:

> "summing means for summing the quantities that all bidders wish to transact at the current price to determine a total quantity of items that bidders wish to transact at the current price;
>
> comparing means, coupled to the summing means, for comparing the total quantity of items that bidders wish to transact at the current price with the available quantity of items;
>
> second determining means, coupled to the comparing means, for determining that the auction should end if the total quantity of items that bidders wish to transact at the current price is no greater than the available quantity of items; and
>
> third determining means, coupled to the comparing means, for determining that the auction should continue if the total quantity of items that bidders wish to transact at the current price exceeds the available quantity of items".

Fig. 2b shows the determining means which includes functions 212-1, 212-2. Function 212-1 performs the summing function and function 212-2 effects a comparison. There is a determination to end the auction (212-2 and path to 212-2) in the event that the sum is no greater than the number of available objects. On the other hand there is a another determination (214, fig, 2a) in the event the auction will continue.

Claims 44, in describing the bid entry terminal, recites:

> "means for receiving current bidding information from the bidding information processor".

Fig. 2a shows function 204 which illustrates the bidding information processor transmitting information to the bid entry terminals, where it is received and displayed to the bidders (10:12-12:2).

Claim 44, in describing the bid entry terminal recites:

> "means, coupled to the bid receiving means, for transmitting a signal representing the bid to the bidding information processor",
>
> and
>
> "means for receiving a bid from a participating bidder, the bid indicating at least an object, or a quantity of objects to be transacted, and an associated price".

Fig. 2a shows function 206 which indicates that the bid entry terminal receives a bid and transmits the bid to the bidding information processor (12:4-9).

Claim 46, in describing the bid entry terminal recites:

> "means for receiving current bidding information from the bidding information processor"
>
> and
>
> "means, coupled to the bid receiving means, for transmitting a signal representing the bid to the bidding information processor"
>
> and
>
> "means for receiving a bid from a participating bidder, a plurality of bids comprising a list of specific objects and a price associated with each object in the list".

Fig. 4 shows a flow chart for a auction which differs from the auctions previously described. Fig. 4 shows function 402 in which information is transmitted from the bidding information processor to the bid entry terminals (15:25-16:17). Function 404 illustrates that a terminal receives bidding information from a bidder and transmits the bid to the BIP. (16:18-21) In the auction implemented in fig. 4 "the participants name their own bids on individual objects." (15:27-16:1) In this case bids "may consist of a list of specific objects and a price offered for each object, or simply a quantity of objects and a price offered for that quantity." (16:19-21).

Claim 46, in describing the bidding information processor, recites:

> "means for determining, separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round,
>
> means for assigning the determined quantity of objects to the determined bidder at the price for the round, said assigning indicating a winning bidder".

The bid, in this claim, is defined as "a list of specific objects and a price associated with each object in the list". Fig. 4 is the flow chart of a process in accordance with an embodiment of the invention with differs from the embodiment illustrated in other figures. Function 408 effects object assignment. This function is described in the specification (16:25-17:5).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

There is a single rejection contained in the final rejection. Claims 44, 46, 59, 61 and 160-173 are rejected under 35 USC 103 as unpatentable over a publication by Anthes in view of another publication of the Washington Telecom News.

VII. ARGUMENT

Summary of the Argument

All the rejected claims patentably distinguish from the subject matter dealt with in the rejection in that the claims include subject matter which is:

a) not described in either of the references, and either

b) not mentioned in the statement of the rejection or

c) the subject of an allegation of obviousness which has no basis in either reference.

Legal Principles

The Final Rejection is solely based on 35 USC 103.

"[A]ll words in the claim must be considered in judging the patentability of the claim against the prior art." *In re Wilson*, 165 USPQ 494, 496 (CCPA 1970). As set forth in section 2111 of the MPEP, "claims are interpreted in the broadest reasonable fashion **consistent with the specification."** (Emphasis added). The Patent and Trademark Office **is required** to take

into account whatever enlightenment is afforded by the specification, *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ 2d 1023, 1027-28 (Fed. Cir. 1997).

As noted in Section 706.02(j) MPEP, three criteria must be met in order to establish a *prima facie* case of obviousness. Most importantly, the prior art reference (or references when combined) must teach or suggest **all** the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure.

As noted by the Board in the prior appeal, one of the elements of a *prima facie* case of obviousness is "a reason why one having ordinary skill in the pertinent art would be led to ... combine the prior art references to arrive at the claimed invention." This requirement is reaffirmed in *KSR INTERNATIONAL CO. v. TELEFLEX INC.* (Sup. Ct. No. 04–1350, April 30, 2007). There the Court said:

> Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all *in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.* (Slip Op. at 14, emphasis added). This necessarily requires treatment of all recitations in any rejected claim.

Preambles that are essential to the claimed invention are limiting because they breathe life, meaning, and vitality into the claims. *Kropa v. Robie* 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951), *In re Stencel*, 828 F.2d 751, 4 USPQ2d 1071 (Fed. Cir. 1987).

Construction of the Claims

The rejected claims include independent apparatus claims 44, 46, 167 and 170 and independent method claims 59, 61, 160 and 163.

Claims 44, 46, 59 and 61 recite "an automated auction for multiple objects in multiple rounds, the auction allowing assignment of identical objects, similar objects or close substitutes at different prices". The meaning of the three words, "identical", "similar" or "close substitutes" indicates the objects can be treated as substitutes for one another.

Claims 44 and 46 call for:

> "means for determining, separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round,
>
> means for assigning the determined quantity of objects to the determined bidder at the price for the round, said assigning indicating a winning bidder".

As noted above this means clause is supported by the functions illustrated in fig. 2c. In particular a sum is produced of the quantities demanded by other bidders. This sum is compared with the quantity available. To the extent the quantity demanded by other bidders is less than the quantity available, the difference can be assigned to the selected bidder. As noted in the claim the assignment indicates "a winning bidder" for the objects which have been assigned. Since the assignment is "at the price for the round", objects assigned in different rounds will be assigned at a different price (the price for the other round) and in this way "identical objects, similar objects or close substitutes" may be assigned at different prices.

The method claims 59 and 61 recite:

> "determining separately, for each of a plurality of bidders, a quantity of objects, if any, to be assigned to the bidder in the current round, and in the event of such a determined quantity, assigning the determined quantity to the determined bidder, said assigning indicating a winning bidder".

At the very least this clause requires:

> 1) some determination be effected "separately for each of a plurality of bidders" whether an assignment is to be made in the current round,
>
> 2) in the event of a positive determination, there is an assignment, and
>
> 3) an assignment indicates "a winning bidder".

The limiting subject matter of claims 44 and 59 requires insuring that a bidder's bid does not violate the requirement that the number of objects in one bid can be "no larger" than the

quantity either (1) contained in a bid in the "preceding round" (claim 44) or (2) contained in a bid "at a preceding price" (claim 59).

Claims 160-173 all specify that the auction is a clock auction[2], an auction in which current prices are announced to bidders as opposed to the bidders themselves naming prices, see McCabe, p. 49. This follows from two recitations in each claim. Claim 160 recites:

"a) transmitting a signal representing information regarding bidding, said information including *at least an indicator of a current price*;

* * *

[the following steps call for receiving bids, processing the bids and generating information on the bidding process, the claim then continues:]

g) *initiating at least one additional opportunity for bidders to submit bids at a new price* following a determination that the auction should continue". (emphasis added)

In step (a) bidders are informed of "a current price". After bids are placed and processed, a "new price" is determined and bidders are allowed an opportunity to bid at the "new price". Auctions in which prices are announced to bidders and, at each price, bidders respond by naming the quantities that they wish to buy or sell are defined as "clock auctions", see also the cited McCabe publication.

Claims 163, 167 and 170 include similar content. The other claims, 161-162, 164-166, 168-169 and 171-173 depend from one of claims 160, 163, 167 and 170. Thus all claims 160-173 specify a clock auction.

Claims 160-162, 164-166, 167-169 and 171-173 specify a clock action and call for constraining bids:

> "so that the quantity contained in a bid at the current time is no greater than the quantity contained in an earlier bid"

while claims 163 and 170 specify a clock action and call for constraining bids:

> "so that the quantity that a bidder wishes to transact at the current price can be no greater than the quantity that the

[2] McCabe et al, "Testing Vickrey's and Other Simultaneous Multiple Unit Versions of the English Auction", Research in Experimental Economics, Vol. #4, Greenwich, CT, JAI Press, 1991, pp 45-79, a copy of which is attached in Appendix B.

> bidder wished to transact at an immediately preceding price".

In the case of all these claims a limit is placed on the quantity in a bid with respect to an earlier bid.

Claims 160-162, and 164-166 recite:

> "summing quantities contained in all bids at the current time to determine a summed quantity of items at the current time;
>
> determining whether the auction should end or continue, based on a comparison of the summed quantity of items at the current time and an available quantity of items;
>
> initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue".

Claims 167-169 and 171-173 contain similar content in an apparatus claim.

These claims require:

> (1) a sum to be taken of quantities in ALL bids "at the current time",
>
> (2) determining whether the auction should end or continue based on a comparison of that sum and "an available quantity of items" and finally
>
> (3) initiating another bidding opportunity at a new price following "a determination that the auction should continue".

Claims 163 recites:

> "determining whether the auction should end or continue, based on a comparison of a sum of quantities that bidders wish to transact at the current price and an available quantity of items;

***

> initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue"

Claim 170 contains similar content in an apparatus claim.

Claims 163 and 170 require:

> (1) determining whether the auction should end or continue based on a comparison of a sum of quantities that bidders wish to transact at the current price and "an available quantity of items" and
>
> (2) initiating another bidding opportunity at a new price following "a determination that the auction should continue".

The dependent claims 161, 162, 168 and 169 depend from claims 160 and 167 which specify "constraining bids" and a closing rule. These dependent claims specify prices at which items are assigned following a determination that the auction should end.

The dependent claims 164 and 171 depend from claims 160 and 167 and specify that updated information includes disaggregated quantities contained in each bid. The dependent claims 165 and 172 specify that the updated bidding information includes a sum of quantities contained in the bids. Dependent claims 166 and 173 specify that a bid indicates quantities of items that a bidder wishes to transact at two or more prices.

SUMMARY OF THE REFERENCES

Anthes

The publication is entitled "FCC Auction built on client/server". The article describes an auction of licenses conducted by the FCC using a computer system. The auction was characterized as a "simultaneous, multiple-round" auction. Bidders could bid simultaneously on any combination of 99 licenses. Bids were submitted electronically and disclosed to all bidders at the end of each round.

Additional rounds were held until no new bid was received for any license.

All licenses remained "open until all close" meaning that all licenses are available to any bidder in any round until the auction closes when all licenses are awarded to the high bidder for each license.

Because all licenses are open until all close there is no "determining, separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round".

There is no indication that any bid includes a "quantity parameter". To the contrary, since each license provides for exclusivity in terms of geography and/or frequency, each license is unique and each bid must individually identify each license which is sought in a bid. Consequently no bid includes a "quantity parameter".

There is no description, in an auction of identical objects, similar objects or close substitutes, of the activity rule "limiting the number of objects on which a bidder may bid to be no larger than a number of objects on which the bidder was allowed to bid in a preceding round," (claims 44 and 59). Likewise there is no description of a clock auction with a feature of "constraining" the quantity contained in a bid based on an earlier bid (claims 160-173). There is no suggestion to take a sum of quantities contained in bids and compare that to the total number of available items and then determine to terminate the auction based on the comparison. To the contrary the closing rule for the auction described here is based on the absence of a new bid in any round. Thus the auction terminates when no new bid is received.

The presence of an activity rule is implied (Bidders must "maintain minimum levels of bidding activity" - p. 2) but without enough specificity to define any particular rule or requirement.

Washington Telecom News

The publication is entitled "WHAT YOU NEED TO KNOW TO BID IN THE FCC'S NARROWBAND AUCTION". The paper describes a prospective FCC auction characterized as a "simultaneous multiple-round auction" where bids will be accepted on all licenses in all rounds and bidding remains open on all licenses until bidding closes on each license. In other words, "bidding will stop simultaneously on all licenses".

The auction "closes if one round passes with no new acceptable bids on any license."

There is no description of a clock auction which has a feature of "constraining" the quantity contained in a bid based on the quantity contained in an earlier bid, (claims 160-173). Because all licenses are open until all close, there is no "determining, separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round".

There is no indication that any bid includes a "quantity parameter". To the contrary, since each license provides for exclusivity in terms of geography and/or frequency, each license is unique and each bid must individually identify each license which is sought in a bid. Consequently no bid includes a "quantity parameter".

There is no suggestion to take a sum of quantities contained in bids and compare that the total number of available items and then determine to terminate the auction based on the comparison. To the contrary, the closing rule for the auction described here is based on the absence of a new bid. Thus the auction terminates when no new bid is received.

An activity rule is applied on bidders throughout the auction. An "active" bidder is either the high bidder (on a particular license) in a prior round or a bidder submitting a bid in a current round which exceeds the prior round high bid by at least the minimum bid increment (p. 2, 2nd paragraph).

The FCC auctions described in the references appear to proceed as follows:

1. The auction is opened, perhaps by identifying the licenses subject to auction.

2. A bidder can bid for a license by offering a price that the bidder is willing to pay. A bidder bids for multiple licenses by identifying a separate price for each individual license.

3. After some time, the bidding is closed. Since this is the initial round another round will be conducted.

4. A new round of bidding is initiated after the high bids on each license are reported to the bidders. In this round, a bidder may bid on a license that has previously received a bid by placing a new bid that exceeds the standing high bid by at least the minimum bid increment. Just as in the initial round, a bidder bids for multiple licenses by identifying a separate price for each individual license.

5. At the close of this round, a determination is made as to whether any new bids have been placed. So long as there has been at least one new bid received in this round, another round of bidding is initiated; if no new bids have been received, the auction is concluded.

6. The steps 4 and 5 are repeated until the determination of step 5 indicates that no new bid has been received. At that time all licenses are awarded – each license is awarded to the high bidder at the close of bidding.

The FCC auctions described in the references differ in important respects from the subject matter of the claims. Some of the differences are:

1. The FCC auctions were not clock auctions. In a clock auction, current prices are announced to bidders as opposed to the bidders themselves naming prices. However, in the FCC auctions, bidders offered the prices that they were willing to pay. Since the FCC auctions were not clock auctions there is no generating current bidding information "including the current price associated with at least one object" nor transmitting that price information to bidders or bidder terminals. (claims 44, 46, 160-162, 164-166, 163, 167-169, 170, 171-173)

2. There is no determination "separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round". There are two determinations in the FCC auction. First, should the auction end? This determination is not effected "separately for a plurality of bidders" since one determination applies to all bidders. The second determination is made with respect to each license and determines which bidder will be awarded the license. Alternatively it could be argued that there is a determination as to each bidder, namely, is this bidder entitled to one or more licenses? However this determination is not with respect to objects to be assigned "in a current round". Since this determination is only made *after* the auction terminates it cannot relate to an assignment "in a current round". (claims 44, 46, 59, 61)

3. There is no "initiating at least one more round of bidding if any objects remain unassigned" since new rounds of bidding depend on the presence of new bids and not the number of unassigned objects. (claims 44, 46, 59, 61)

4. There is no description, in an auction of identical objects, similar objects or close substitutes, of limiting "the number of objects on which a bidder may bid to be no larger than a number of objects on which the bidder was allowed to bid in a preceding round." (claims 44, 59)

5. None of the bids include a "quantity parameter", since each license must be individually identified and associated with a value the bidder is offering for that license. (claims 160-162, 164-166, 167-169, 171-173)

6. There is no determining to terminate an auction by comparing "the summed quantity of items [contained in all bids] at the current time and an available quantity of items". (claims 160-162, 163, 164-166, 167-169, 170, 171-173).

7. There is no description, in a clock auction, of "constraining" the quantities contained in a bid to be no greater than the quantity contained in an earlier bid . (claims 160-173)

THE FINAL REJECTION

The Examiner's position in the Final rejection (aside from specifying the rejected clams, the statutory basis, the identification of the references and paraphrasing applicant's arguments) is contained in four paragraphs. (While the Final Rejection also refers to the preceding action of May 2006, rejected claims were amended following the earlier action). With respect to claims 44, 46, 59 and 61 the examiner argued that

> the auction described in the Washington Telecom News is an auction of "multiple licenses or paired licenses for one or more rounds at different prices" (p. 2).

With respect to claims 44 and 59 the Examiner argued that:

> constraining bids in the recited manner (limiting the number of objects on which a bidder may bid to be no larger than a number of objects on which the bidder was allowed to bid in a preceding round) "would have been obvious ... because such would have prevented the system in not having available objects to award a winning bidder" (p. 3)

With respect to claims 160-173 the Examiner argued that

> (1) constraining bids in the recited manner "would have been obvious ... because such would have prevented the system in not having available objects to award a winning bidder" (p. 3), and
>
> (2) "in a given auction certain conditions (determining whether the auction should end or continue based on a comparison of the summed quantity of items contained in all bids and an available quantity) would result in the termination or continuation of the auction. Thus, providing the recited conditions is regarded as one of a plurality of conditions that may be desired the particular auctioneer as such does not result in patentable subject differences apart from the auction noted by the FCC as described by Anthes.".

Finally, with respect to claims 160-162 and 167-169 (at least one bid including a quantity parameter) the Examiner argued "in most auctions the number of desired objects or quantity of a given object is usually provided by a bidder. A bidder usually bids on one or more items or one or more of a number of items in a given auction. Anthes also teaches a bidder may bid on one or more licenses." (pp 3-4)

In the earlier action (May 4, 2006) the examiner asserted that Anthes described "determining at a computer, for each of a plurality of bidders, a quantity of items, if any, to be unassigned (sic – assigned) at the current time" (p. 3) relying on p. 2, first paragraph of the reference, as well as "initiating at a computer at least one additional opportunity for bidders to submit bids if any items remain unassigned".

The examiner argued in the May 2006 action that Anthes described "allowing assignment of items at different prices" (p. 2). The claims were amended after the May 2006 action to specify that the items that were assigned at different prices were "identical objects, similar objects or close substitutes". There is no assertion in the Final Rejection that either reference allows assignment of "identical objects, similar objects or close substitutes" at different prices.

In the earlier action the examiner drew a parallel between the assigning action in the rejected claims and the Washington Telecom News description of an active bidder (p. 5 of the May 2006 rejection) in an attempt to bolster the obviousness rejection.

The Final rejection fails to mention the subject matter of any of claims 161-162, 164-166, 168-169 and 171-173.

CLAIMS 44, 46, 59 AND 61 PATENTABLY DEFINE OVER THE REFERENCES

Claims 44 and 46 patentably define over the references with respect to the recitations

> "means for determining, separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round,

> means for assigning the determined quantity of objects to the determined bidder at the price for the round, said assigning indicating a winning bidder,
>
> ****
>
> means for generating updated bidding information and initiating at least one more round of bidding if any objects remain unassigned"
>
> (claims 59 and 61 contain method recitations of similar import)

While the cited references allow any bidder to bid for any license subject to the FCC auction, at any time until the auction is terminated, certain items at an auction conducted in accordance with claims 44, 46, 59 or 61 may have been assigned in a previous round and are unavailable to the bidder. As set forth in these claims, a determination is effected "separately for a plurality of bidders" of a quantity of objects if any to be assigned in the current round. As is set forth in the claims, if there is such a determination, then that quantity is assigned in the current round. Note the claims state "said assigning indicating a winning bidder". The determining and assigning is not a feature described in either reference and as applicant has pointed out is a feature which is not mentioned in the final rejection.

In the May rejection the examiner attempted to draw a parallel between an "active" bidder (as described in the Washington Telecom News) and the bidder to whom an item has been assigned per these claims. The argument is not repeated in the Final rejection – however the Final rejection does refer back to the May rejection and so applicant is unsure as to whether the arguments in the earlier action were relied on. In any event there is no relation between an "active" bidder (Washington Telecom News) and the bidder to whom an item has been assigned as specified in the rejected claims (the "winning bidder"). The dichotomy is apparent when considering that:

(1) in any round of the FCC auction there may be many "active" bidders on a given license, i.e., any bidder with the standing high bid or a bid exceeding the prior standing high bid by the minimum bid increment is an "active" bidder, and

(2) the high bidder on a particular license in one round of the FCC auction may not remain the high bidder on that same license in the next round, and

(3) the winning bidder per these claims has been assigned the item, i.e., the auction is over with respect to that item.

Thus the Washington Telecom News description of an "active" bidder bears no relation to the determining and assigning of the rejected claims.

The recitation calling for "initiating at least one more round of bidding if any objects remain unassigned" also distinguishes from the references. While additional rounds of bidding are initiated in the FCC auctions, there is no round of bidding which is initiated "if any object remains unassigned". Rather additional rounds of bidding are initiated in the FCC action so long as the auction is not terminated – and termination depends on whether or not any new bid is detected. Clearly the Examiner has failed to make out a *prima facie* case of obviousness of claims 44, 46, 59 and 61.

CLAIMS 44 AND 59 PATENTABLY DEFINE OVER THE REFERENCES WITH RESPECT TO THE "LIMITING" RECITATION

These claims patentably define over the references with respect to:

> means for limiting the number of objects on which a bidder may bid to be no larger than a number of objects on which the bidder was allowed to bid in a preceding round (claim 44, claim 59 contains a method recitation of similar import).

The Examiner argues in the final rejection that this subject matter "would have been obvious . . . because such would have prevented the system in not having available objects to award a winner bidder". Applicant submits the allegation in the final rejection evidences the fact that subject matter is not found in either reference. Further the allegation of obviousness has no relation to the content of the claim recitation. The claim recitation "limiting the number of objects on which a bidder may bid to be no larger than a number of objects on which the bidder was allowed to bid in a preceding round" has no connection at all with the Examiner's argument

that "such would have prevented the system in not having available objects to award a winning bidder."

In as much as neither reference contains subject matter corresponding to this recitation and there is no cogent reason expressed in the final rejection for ignoring the recitation or considering it obvious, Applicant submits that there is no *prima facie* case of obviousness in connection with these claims.

CLAIMS 160-173 PATENTABLY DEFINE OVER THE REFERENCES WITH RESPECT TO THE CONSTRAINING RECITATION AND THE TERMINATION CLAUSES

Claims 160-162 and 164-166 specify a clock auction and recite:

> "constraining bids so that the quantity contained in a bid at the current time is no greater than the quantity contained in an earlier bid
>
> summing quantities contained in all bids at the current time to determine a summed quantity of items at the current time;
>
> determining whether the auction should end or continue, based on a comparison of the summed quantity of items at the current time and an available quantity of items;
>
> ***
>
> initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue".

The "constraining bids" recitation, is referred to at page 3 of the final rejection, and allegedly "would have been obvious . . . because such would have prevented the system in not having available objects to award a winning bidder". Applicant submits the argument in the final rejection bears no resemblance to the content of the claim recitation. The claim recitation is specific to ensuring that a given bid does not contain a quantity which is larger than in an earlier bid.

The next two recitations in these claims, "summing quantities . . ." "determining whether. . ." together define the closing rule for the auction. First a sum is taken of "quantities contained in all bids at the current time." Thereafter, a determination is effected as to whether the auction should end or continue, that determination is "based on a comparison of the summed quantity of items at the current time and an available quantity of items." The final rejection does not argue that this subject matter is found in either reference. Rather, the final rejection states that these recitations "is regarded of a one of plurality of conditions that may be desired the particular auctioneer as such does not result in patentable subject differences apart from the auction noted by the FCC is described by Anthes." Applicant is not at all sure what the foregoing means, but at the very least it does not establish a *prima facie* case of obviousness.

Finally, the "initiating at least one additional opportunity" . . . recitation also patentably distinguishes from the combination of references. While the auctions described in the references do occur in rounds, it is apparent that the auctions described in the references do not involve initiating a new round "following a determination that the auction should continue" where that determination is, as recited in the claims, based on "a comparison of the summed quantity of items at the current time and an available quantity of items". In as much as there is no statement in the final rejection regarding this recitation, it is apparent that there is not a *prima facie* case of obviousness.

Claims 167-169 and 171-173 call for a clock auction and recite:

> "constraining means for constraining bids so that the quantity contained in a bid at a current time can be no greater than the quantity contained in an earlier bid, summing means for summing the quantities that all bidders wish to transact at the current time to determine a summed quantity of items that bidders wish to transact at the current time;
>
> determining means for determining whether the auction should end or continue, based on a comparison of the summed quantity of items that bidders wish to transact at the current time and an available quantity of items;
>
> ***

> initiating means for initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue."

The "constraining means" recitation is, Applicant asserts, novel over either reference taken alone, (the Examiner has not alleged that this subject matter is found in either reference). Furthermore, the argument in the final rejection that the subject matter would have been obvious "because such would have prevented the system and not having available objects to award a winner bidder" is not rationally related to the content of the recitation. The recitation is an activity rule limiting the freedom of a bidder to bid. Applicant submits there is no basis in the office action for concluding this subject matter would have been obvious.

The "summing means" and "determining means" recitations are, as Applicant indicated the closing rule for the auction. Applicant has argued elsewhere that neither reference describes such a closing rule and there is no cogent basis in the final rejection to support a prima facie case of obviousness.

The "initiating means" recitation also patentably distinguishes from the combination of references. While the auctions described in the references do occur in rounds so that there are many new rounds which are initiated, it is apparent that the auctions described in the references do not involve initiating a new round "following a determination" which is based on "a comparison of the summed quantity of items at the current time and an available quantity of items". Inasmuch as there is no statement in the final rejection regarding this recitation, it is apparent that there is not a *prima facie* case of obviousness.

Claim 163 calls for a clock auction and recites:

> "constraining bids so that the quantity that a bidder wishes to transact at the current price can be no greater than the quantity that the bidder wished to transact at an immediately preceding price;
>
> determining whether the auction should end or continue, based on a comparison of a sum of quantities that bidders wish to transact at the current price and an available quantity of items;

> ***
>
> initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue;"

Claim 170 calls for a clock auction and recites:

> "constraining means for constraining bids so that the quantity that the bidder wishes to transact at the current price can be no greater than the quantity that the bidder wished to transact at an immediately preceding price;
>
> determining means for determining whether the auction should end or continue, based on a comparison of a sum of quantities that bidders wish to transact at the current price and an available quantity of items;
>
> ***
>
> initiating means for initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue;"

The "constraining means" recitation is, Applicant asserts, novel over either reference taken alone (the Examiner has not alleged that this subject matter is found in either reference). Furthermore, the argument in the final rejection that the subject matter would have been obvious "because such would have prevented the system and not having available objects to award a winner bidder" is not rationally related to the content of the recitation. The recitation is an activity rule limiting the freedom of a bidder to bid. Applicant submits there is no basis in the office action for concluding this subject matter would have been obvious.

The "summing means" and "determining means" recitations are, as Applicant indicated the closing rule for the auction where Applicant has argued elsewhere that neither reference describe such a closing rule and there is no cogent basis in the final rejection to support a *prima facie* case of obviousness.

The "initiating" recitation also patentably distinguishes from the combination of references. While the auctions described in the references do occur in rounds so that there are many new rounds which are initiated, it is apparent that the auctions described in the references do not involve initiating a new round "following a determination" which is based on "a comparison of the summed quantity of items at the current time and an available quantity of items". Inasmuch as there is no statement in the final rejection regarding this recitation, it is apparent that there is not a *prima facie* case of obviousness.

The dependent claims 161, 162, 168 and 169 depend from claims that specify "constraining bids" and a closing rule. These claims specify prices at which items are assigned following a determination that the auction should end. These claims further differ from the content of the references since in the auction described in these references licenses are awarded to the high bidder at the end of the auction. The reference auctions do not have the concept of a price set for a round. However these claims specify that items are awarded at the price of the last round – there is nothing in theses references corresponding to these claims.

The dependent claims 164 and 171 specify that updated information includes disaggregated quantities contained in each bid. The dependent claims 165 and 172 specify that the updated bidding information includes a sum of quantities contained in the bids. Dependent claims 166 and 173 specify that a bid indicates quantities of items that a bidder wishes to transact at two or more prices. The references fail to reach this subject matter.

Since the Final Rejection fails to mention the subject matter of any of claims 161-162, 164-166, 168-169 and 171-173 it is apparent the claims distinguish from these references for the reasons noted above. Since the claims distinguish from the references and the Final Rejection fails to address this subject matter is also apparent there is no *prima facie* case of obviousness.

In view of the foregoing it is evident that the Final Rejection fails to set forth a *prima facie* case of obviousness as to any of the rejected claims (44, 46, 59, 61, 160-173). Reversal of the rejection is respectfully solicited.

VIII. CLAIMS

A copy of the claims involved in the present appeal is attached hereto as Appendix A. As indicated above, the claims in Appendix A include the amendments filed by Applicant on August 1, 2006.

Applicant believes no other fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 22-0185, under Order No. 21736-00012-US from which the undersigned is authorized to draw.

Dated: 5/7/07

Respectfully submitted,

By _____

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APPENDIX A

Claims Involved in the Appeal of Application Serial No. 09/397,008

Claim 44. A system for conducting an automated auction for multiple objects in multiple rounds, the auction allowing assignment of identical objects, similar objects or close substitutes at different prices, the system comprising: a plurality of bid entry terminals, the bid entry terminals operated by bidders;

a bidding information processor, the bidding information processor being communicatively coupled to bid entry terminals and comprising:

means for generating current bidding information including at least the current price associated with at least one object,

means, coupled to the generating means, for transmitting a signal representing current bidding information from the bidding information processor to bid entry terminals,

means for receiving bids from bid entry terminals,

means for determining, separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round,

means for assigning the determined quantity of objects to the determined bidder at the price for the round, said assigning indicating a winning bidder, and

means for generating updated bidding information and initiating at least one more round of bidding if any objects remain unassigned;

each bid entry terminal comprising:

means for receiving a bid from a participating bidder, the bid indicating at least an object, or a quantity of objects to be transacted, and an associated price,

means for limiting the number of objects on which a bidder may bid to be no larger than a number of objects on which the bidder was allowed to bid in a preceding round,

means, coupled to the bid receiving means, for transmitting a signal representing the bid to the bidding information processor, and

means for receiving current bidding information from the bidding information processor.

Claim 46. A system for conducting an automated auction for multiple objects in multiple rounds, the auction allowing assignment of identical objects, similar objects or close substitutes at different prices, the system comprising:

a plurality of bid entry terminals, the bid entry terminals operated by bidders;

a bidding information processor, the bidding information processor being communicatively coupled to bid entry terminals and comprising:

means for generating current bidding information including at least ~~the~~ a current price associated with at least one object,

means, coupled to the generating means, for transmitting a signal representing current bidding information from the bidding information processor to bid entry terminals,

means for receiving bids from bid entry terminals,

means for determining, separately for a plurality of bidders, a quantity of objects, if any, to be assigned in a current round,

means for assigning the determined quantity of objects to the determined bidder at the price for the round, said assigning indicating a winning bidder, and

means for generating updated bidding information and initiating at least one more round of bidding if any objects remain unassigned;

each bid entry terminal comprising:

means for receiving a bid from a participating bidder, a plurality of bids comprising a list of specific objects and a price associated with each object in the list,

means, coupled to the bid receiving means, for transmitting a signal representing the bid to the bidding information processor, and

means for receiving current bidding information from the bidding information processor.

Claim 59. In a system including a plurality of bid entry terminals operated by bidders, and a bidding information processor, the bidding information processor being communicatively coupled to bid entry terminals, a method for conducting an automated auction for multiple objects in multiple rounds, the auction allowing assignment of identical objects, similar objects or close substitutes at different prices, the method comprising:

a) transmitting a signal representing current bidding information from the bidding information processor to a plurality of the bid entry terminals;

b) allowing participating bidders to enter bids at bid entry terminals, a bid indicating at least an object, or a quantity of objects, and an associated price;

c) limiting the number of objects on which a bidder is allowed to bid so as not to be larger than the number of objects on which the bidder actually bid at a preceding price;

d) transmitting a signal representing a bid from a bid entry terminal which received the bid;

e) determining separately, for each of a plurality of bidders, a quantity of objects, if any, to be assigned to the bidder in the current round, and in the event of such a determined quantity, assigning the determined quantity to the determined bidder, said assigning indicating a winning bidder;

f) generating updated bidding information at the bidding information processor; and

g) initiating at least one additional round of bidding if at least one object remains unassigned.

Claim 61. In a system including a plurality of bid entry terminals operated by bidders, and a bidding information processor, the bidding information processor being communicatively coupled to bid entry terminals, a method for conducting an automated auction for multiple objects in multiple rounds, the auction allowing assignment of identical objects, similar objects or close substitutes at different prices, the method comprising:

a) transmitting a signal representing current bidding information from the bidding information processor to a plurality of the bid entry terminals;

b) allowing participating bidders to enter bids at bid entry terminals, a bid indicates a list of specific objects and a price associated with each object in the list;

c) transmitting a signal representing a bid from a bid entry terminal which received a bid;

d) determining separately, for each of a plurality of bidders, a quantity of objects, if any, to be assigned to the bidder in a current round, and in the event of such a

determined quantity, assigning the determined quantity to the determined bidder, said assigning indicating a winning bidder;

e) generating updated bidding information at the bidding information processor; and

f) initiating at least one additional round of bidding if at least one object remains unassigned.

Claim 160. A method for conducting an auction of a plurality of items, the auction allowing submission of bids on the items at a plurality of times, the method comprising:

a) transmitting a signal representing information regarding bidding, said information including at least an indicator of a current price;

b) receiving bids submitted by a plurality of bidders, each said bid indicating at least a quantity of the items that a bidder wishes to transact at a current time and at least one bid including a quantity parameter indicating a quantity of the items that a bidder wishes to transact at the current time;

c) constraining bids so that the quantity contained in a bid at the current time is no greater than the quantity contained in an earlier bid;

d) summing quantities contained in all bids at the current time to determine a summed quantity of items at the current time;

e) determining whether the auction should end or continue, based on a comparison of the summed quantity of items at the current time and an available quantity of items;

f) generating updated information regarding the bidding process; and

g) initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue.

Claim 161. The method of claim 160 which further includes assigning quantities contained in bids, at prices related to the current price, to the respective bidders following a determination that the auction should end.

Claim 162. The method of claim 160 which further includes assigning quantities contained in bids, at the current price, to the respective bidders following a determination that the auction should end.

Claim 163. A method for conducting an auction of a plurality of items, the auction allowing submission of bids on the items at a plurality of times, the method comprising:

a) transmitting a signal representing information regarding bidding, said information including at least an indicator of a current price;

b) receiving bids submitted by a plurality of bidders, each bid indicating at least a quantity of the items that a bidder wishes to transact at the current price;

c) constraining bids so that the quantity that a bidder wishes to transact at the current price can be no greater than the quantity that the bidder wished to transact at an immediately preceding price;

d) determining whether the auction should end or continue, based on a comparison of a sum of quantities that bidders wish to transact at the current price and an available quantity of items;

e) generating updated information regarding the bidding process; and

f) initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue;

wherein the determining comprises:

g) summing the quantities that all bidders wish to transact at the current price to determine a total quantity of items that bidders wish to transact at the current price;

h) if the total quantity of items that bidders wish to transact at the current price is greater than the current quantity of available items, determining that the auction should continue; and

i) if the total quantity of items that bidders wish to transact at the current price is not greater than the current quantity of available items, determining that the auction should end.

Claim 164. The method of claim 160 wherein the updated information regarding the bidding process includes disaggregated quantities contained in each bid at the current price.

Claim 165. The method of claim 160 wherein the updated information regarding the bidding process includes a sum of quantities contained in said bids at the current price.

Claim 166. The method of claim 160 wherein a bid indicates quantities of items that a bidder wishes to transact at two or more prices.

Claim 167. A system comprising at least one computer for implementing an auction of a plurality of items, the auction allowing submission of bids on the items at a plurality of times, the system comprising:

a) transmitting means for transmitting a signal representing information regarding bidding, said information including at least an indicator of a current price;

b) receiving means for receiving bids submitted by a plurality of bidders, each said bid indicating at least a quantity of the items that a bidder wishes to transact at the current time and at least one said bid including a quantity parameter indicating a quantity of the items that a bidder wishes to transact at the current time;

c) constraining means for constraining bids so that the quantity contained in a bid at a current time can be no greater than the quantity contained in an earlier bid;

d) summing means for summing the quantities that all bidders wish to transact at the current time to determine a summed quantity of items that bidders wish to transact at the current time;

e) determining means for determining whether the auction should end or continue, based on a comparison of the summed quantity of items that bidders wish to transact at the current time and an available quantity of items;

f) generating means for generating updated information regarding the bidding process; and

g) initiating means for initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue.

Claim 168. The system of claim 167 which further includes assigning means for assigning quantities that bidders wish to transact, at prices related to the current price, to the respective bidders following a determination that the auction should end.

Claim 169. The system of claim 167 which further includes assigning means for assigning quantities that bidders wish to transact, at the current price, to the respective bidders following a determination that the auction should end.

Claim 170. A system comprising at least one computer for implementing an auction of a plurality of items, the auction allowing submission of bids on the items at a plurality of times, the system comprising:

a) transmitting means for transmitting a signal representing information regarding bidding, said information including at least an indicator of a current price;

b) receiving means for receiving bids submitted by a plurality of bidders, each bid indicating at least a quantity of the items that a bidder wishes to transact at the current price;

c) constraining means for constraining bids so that the quantity that the bidder wishes to transact at the current price can be no greater than the quantity that the bidder wished to transact at an immediately preceding price;

d) determining means for determining whether the auction should end or continue, based on a comparison of a sum of quantities that bidders wish to transact at the current price and an available quantity of items;

e) generating means for generating updated information regarding the bidding process; and

f) initiating means for initiating at least one additional opportunity for bidders to submit bids at a new price following a determination that the auction should continue

wherein the determining means comprises:

g) summing means for summing the quantities that all bidders wish to transact at the current price to determine a total quantity of items that bidders wish to transact at the current price;

h) comparing means, coupled to the summing means, for comparing the total quantity of items that bidders wish to transact at the current price with the available quantity of items;

i) second determining means, coupled to the comparing means, for determining that the auction should end if the total quantity of items that bidders wish to transact at the current price is no greater than the available quantity of items; and

j) third determining means, coupled to the comparing means, for determining that the auction should continue if the total quantity of items that bidders wish to transact at the current price exceeds the available quantity of items.

Claim 171. The system of claim 167 wherein the updated information regarding the bidding process includes the disaggregated quantities that each bidder wishes to transact at the current price.

Claim 172. The system of claim 167 wherein the updated information regarding the bidding process includes a sum of quantities that all bidders wish to transact at the current price.

Claim 173. The system of claim 167 wherein a bid indicates quantities of items that a bidder wishes to transact at two or more prices.

APPENDIX B

A copy of evidence pursuant to §§ 1.130, 1.131, or 1.132 and/or evidence entered by or relied upon by the examiner that is relevant to this appeal is attached hereto.

Attached is a copy of McCabe et al, "Testing Vickrey's and Other Simultaneous Multiple Unit Versions of the English Auction", Research in Experimental Economics, Vol. #4, Greenwich, CT, JAI Press, 1991, pp 45-79. This was cited by applicant in an IDS of Sept 23, 2003 and acknowledged by the Examiner on March 29, 2004.

TESTING VICKREY'S AND OTHER SIMULTANEOUS MULTIPLE UNIT VERSIONS OF THE ENGLISH AUCTION

Kevin A. McCabe, Stephen J. Rassenti, and Vernon L. Smith

I. INTRODUCTION

With advances in communications and information processing we observe greater use of organized "call markets" (those in which bids for the good are "called" for at a particular point in time). Vickrey (1961) has shown that the choice of auction can affect the outcome and should not be a matter of indifference. For example, an inefficient allocation may cause some of the buyers to resell units. Because retrading is costly, society should prefer an initial allocation that is efficient. Similarly, sellers should prefer to capture rents that would otherwise accrue to middlemen.

Research in Experimental Economics, Volume 4, pages 45–79.

ISBN: 0-89232-652-2

In designing a new auction we start with a 'thought experiment': a hypothetical auction. As the thought experiment is refined a theoretical model is built. At this stage the auction is still hypothetical because it remains detached from the many operational issues dealing mostly with message dynamics and the formation of expectations. Clearly, the design is not finished until a 'successful' operating form of the hypothetical auction is found.

We call an operating form of a hypothetical auction an implementation. Historically, an implementation is made in the field, at great cost, with only relative measures of success. Using the laboratory as a test bed for implementations we can reduce costs, better measure performance, and move much closer to the 'best' implementation.

In this paper, we use the laboratory to test different implementations of auctions to sell multiple units of a homogenous good. Table 1 lists these auctions. Vickrey (1961, 1976) describes a number of auction mechanisms that are efficient as long as buyers have independent private values for at most one unit. For the special case of a single unit, English auctions are known to work well both in theory and in experimental tests. However, the sequential use of single unit English auctions to effect multiple unit sales is questionable because it poses a difficult problem of strategic uncertainty for the participants; that is, the optimal bid in each auction requires an assessment of the probability distribution of the lowest price in all future auctions (see the discussions in Vickrey [1976] and Burns [1985]).

Table 1. Types of Auctions

	Auction Name	*Type**	*Description*
1.	Uniform Price	SB	Baseline (experiments in Cox, Smith, Walker [1986]).
2.	English Clock	EC	Baseline (experiments in McCabe, Rassenti, Smith [1988]).
3.	Vickrey Matching	M	Vickrey (1976) Uniform Price Variant of Multiple Unit English Auction
4.	Full Matching	M	Modified Vickrey Matching guarantee's sale of all units.
5.	Vickrey Backtracking	M	Modified Vickrey Matching allows bids to backtrack.
6.	Simultaneous Bidding	SIM	Vickrey (1961) Variant of Multiple Unit English Auction.
7.	First Rejected	SIM	Modified Simultaneous Bidding with Uniform Price equal to First Rejected Final Bid.
8.	Last Accepted	SIM	Modified Simultaneous Bidding with Uniform Price equal to Last Accepted Final Bid.

Note: * SB = Sealed Bid.
EC = English Clock.
M = Matching.
SIM = Simultaneous Bidding.

In the field, homogenous multiple units are sometimes sold in uniform-price, sealed-bid auctions. For example, Stated Rate Auction Preferred Stock, called "STRAPS," uses a uniform price auction to determine the current dividend rate and allocation of shares in a "call market," which is opened every 49 days. Because Vickrey has shown that these auctions are efficient (at least when no buyer desires more than one unit), it is tempting to conclude that their existence in the field confirms that uniform price sealed bid auctions are 'best.' However, in the field efficiency cannot be directly measured; in the laboratory where efficiency can be directly measured, Miller and Plott (1985) and Cox, Smith, and Walker (1985) have found lower efficiencies for uniform price auctions relative to the theoretical prediction. This suggests that there is room for improvement.

II. ECONOMIC ENVIRONMENT AND EXPERIMENTAL PROCEDURES

The economic environment used in all our experiments consists of a fixed supply of four homogeneous units of a good and ten prospective buyers. It is known in advance that the buyers desire (or are restricted to buy) at most one unit of the good and that the buyers' reservation values are independent and private.

In these experiments we use the same values that were used in Cox, Smith, and Walker (1985) to study sealed-bid auctions. In Cox, Smith, Walker, subjects' resale values were drawn with replacement from a uniform distribution with support (0, 224). Table 2 shows the values that were drawn for subjects in each of the 22 auctions.

Subjects were recruited from the undergraduate population at the University of Arizona. They were paid three dollars at the beginning of each experiment as an incentive to participate. At the end of each experiment subjects were paid their salient earnings in U.S. dollars.

When players showed up they were given a set of written instructions for the auction institution used that day (see Appendices I and II). Players were asked to read the instructions and then listen to a brief example presented by one of the experimenters. After the instructions were finished and any questions answered the experiment was begun.

Each experiment consisted of up to 22 auctions, all of which used the same

Table 2. Subject Values

Period	Buyers 1	2	3	4	5	6	7	8	9	10	Theoretical Surplus B	S	T
1	15	39	4	[182]	135	[194]	82	[159]	94	[136]	131	540	671
2	[90]	78	62	19	31	64	46	[202]	[112]	[91]	183	312	495
3	[178]	116	109	50	99	[210]	[211]	7	50	[216]	351	464	815
4	32	[212]	94	[122]	84	10	[177]	17	[193]	27	328	376	704
5	[166]	4	33	58	[65]	[190]	[66]	40	29	18	255	232	487
6	30	[136]	21	[143]	85	[149]	[146]	80	15	85	234	340	574
7	39	100	57	[110]	[143]	84	59	[120]	53	[123]	96	400	496
8	[185]	53	148	49	92	59	[158]	0	[177]	[196]	124	592	716
9	82	92	[146]	[203]	[162]	48	[195]	44	135	72	166	540	706
10	[181]	68	[220]	103	[146]	[207]	98	43	110	11	314	440	754
11	[118]	29	5	[134]	90	[133]	85	81	[123]	93	136	372	508
12	[203]	8	46	[103]	[118]	57	81	99	[193]	7	221	396	617
13	[153]	14	[182]	87	[122]	44	[163]	85	49	98	228	392	620
14	[208]	12	2	41	[120]	[202]	28	71	[132]	78	350	312	662
15	97	[165]	[170]	[137]	70	[132]	43	109	123	32	112	492	604
16	59	[207]	98	2	15	[103]	7	11	[223]	[158]	299	392	691
17	154	[203]	[182]	133	135	102	102	[209]	1	[213]	191	616	807
18	[164]	27	[205]	101	1	[129]	[101]	27	21	76	195	404	599
19	44	[130]	42	81	[137]	81	[134]	80	[116]	114	61	456	517
20	[137]	81	[208]	25	[136]	[219]	120	14	56	1	220	480	700
21	[206]	[217]	[194]	97	32	131	[193]	33	188	104	58	752	810
22	[220]	122	[190]	130	91	[169]	69	71	[174]	160	113	640	753
Total Profit	762	414	508	270	237	760	407	223	481	304	4366		

Notes: Winning bids are set in brackets; fifth highest values are underlined.
B refers to Buyers; S refers to Sellers.

institutional rules. An auction started after each player was sent his private resale value on his computer terminal. The auction was run by hand at the front of the room with one of the experimenters acting as auctioneer. In order to send a message a subject raised a card with his ID number. Once recognized, a subject could then announce his/her bid. If more than one card was raised simultaneously the auctioneer chose one.

When the auction ended, prices and winners were announced while profits were computed and sent privately to subjects' terminals. Subjects' profits were calculated as either zero (if they did not win a unit) or the difference between their resale value and the final auction price (if they did win a unit). Subjects were allowed to make negative profits in any period. However, it was made clear that their total profit would be set to zero if it was negative at the end of the experiment. In all of our experiments subjects earned a positive total profit. Subjects were told they would be (and were) paid three times their total profit (rounded up to the nearest quarter) at the end of the experiment. We tripled payoffs in an attempt to maintain the same degree of saliency as in the earlier Cox, Smith, Walker experiments.

III. THE BASELINE INSTITUTIONS

In McCabe, Rassenti, and Smith (1988) a uniform price English auction is implemented with an automated English Clock. Herein we call this auction English Clock. In an English Clock auction the current bid is automatically incremented by a fixed rule. At each new bid buyers indicate their willingness to buy. At any point a buyer can exit but he or she cannot reenter the current auction. The auction ends as soon as the number of buyers left equals the number of units to be sold. The uniform price is the price on the clock when the auction ends. By reducing the message space to a simple exit decision, and removing control over price from subjects, MRS find that the English Clock performs very close to Dominant Strategy (i.e., price will equal fifth highest value) predictions. In this paper we use the English Clock as one of our Baseline institutions.

In Cox, Smith, and Walker (1985) a uniform price, sealed bid auction was run in the same environment shown in Table 2. The uniform price is the first rejected bid giving a dominant strategy to bid value. Because real time oral auctions give subjects a chance to respond to market information the uniform price sealed bid auctions with no feedback offers an interesting alternative baseline.

Models and Predictions

The formal analysis of our baselines will familiarize the reader with the notation used throughout this paper. We assume that there are n buyers, indexed by i, who each value one unit of a homogenous good. Let v_i be buyer i's value. We

further assume that the v_i's are uniformly drawn from V^{min} to V^{max} and that this is common knowledge to the buyers. Finally, we assume there are m units of the good to be sold.

In a uniform-price, sealed-bid auction each buyer sends the bid message

$$b_i \in [0, V^{max}]$$

indicating his or her willingness to buy. Bids are arranged from highest to lowest and the set $B = \{i : b_i$ is one of the m highest bidders$\}$ is determined. Price P is set to the $m + 1$ highest bid and the allocation vector,

$$C = (C_1, \ldots, C_m)$$

satisfies: for all $j \in B$ there exists a unique i such that $C_i = j$.

A payoff to i is given by

$$\pi_i (C, P) = \begin{cases} V_i - P \text{ if } i \in C. \\ 0 \text{ otherwise.} \end{cases}$$

It is easy to see that each player i has a dominant strategy to bid value, that is, $b_i^* = v_i$. Notice, bidding $b_i < v_i$ only reduces i's chances of being in B without changing price if i is in B, while bidding $b_i > v_i$ will improve i's chances of being in B only when bidding b_i^* means $i \notin B$ and $\pi_i = 0$. But in this case there are n bids higher than v_i and if i gets into B with $b_i > v_i$ then $P > v_i$ and $\pi_i (P,C) < 0$.

In the English Clock auction we introduce time with the superscript t. We denote the clock price at t by P^t. At each t buyers submit bid strategies

$$b_i^t \in [0, V^{max}] \text{ if } i \in B^{t-1}, \text{ and,}$$
$$b_i^t = 0 \text{ if } i \notin B^{t-1}$$

where the set B^t is defined to be the IDs of the buyers who are willing to pay more than the clock price, that is,

$$B^t = \{i : b_i^t \geq P^t\}.$$

Let d^t be the number of buyers in B^t, then the English Clock is represented by the function

$$P^t = E (P^{t-1}, d^{t-1})$$

such that $P^t - P^{t-1} > \epsilon > 0$. The auction stops at $\hat{t}$ such that

$$d^{\hat{t}-1} > m \text{ and } d^{\hat{t}} \leq m.$$

When the auction stops $P = P^{\hat{t}}$ and $C = (C_1, \ldots, C_m)$ is the final allocation vector that satisfies: for all $j \in B^{\hat{t}}$ there exists a unique i such that $C_i = j$ and $C_k \notin B^{\hat{t}} \rightarrow C_k = 0$.

Clearly, if $b_i^t < P^t$ for any $t \leq \hat{t}$ then $\pi_i = 0$. So it is a dominant strategy for buyers to bid $b_i^t \geq P^t$ as long as $P^t \leq v_i$ since this implies $\pi_i \geq 0$.

Experimental Results

In Figure 1 we plot price differences (from the theoretical fifth highest value) for the English Clock and Uniform Price. Notice that the English Clock tracks predicted price well while Uniform Price exhibits large variances from predicted price. This carries over to the comparison of mean efficiency (99.98 for English Clock and 97.36 for Uniform Price). We find it easy to reject the hypothesis that Uniform Price does as well as English Clock (a t-test results in t (d.f. = 86) =

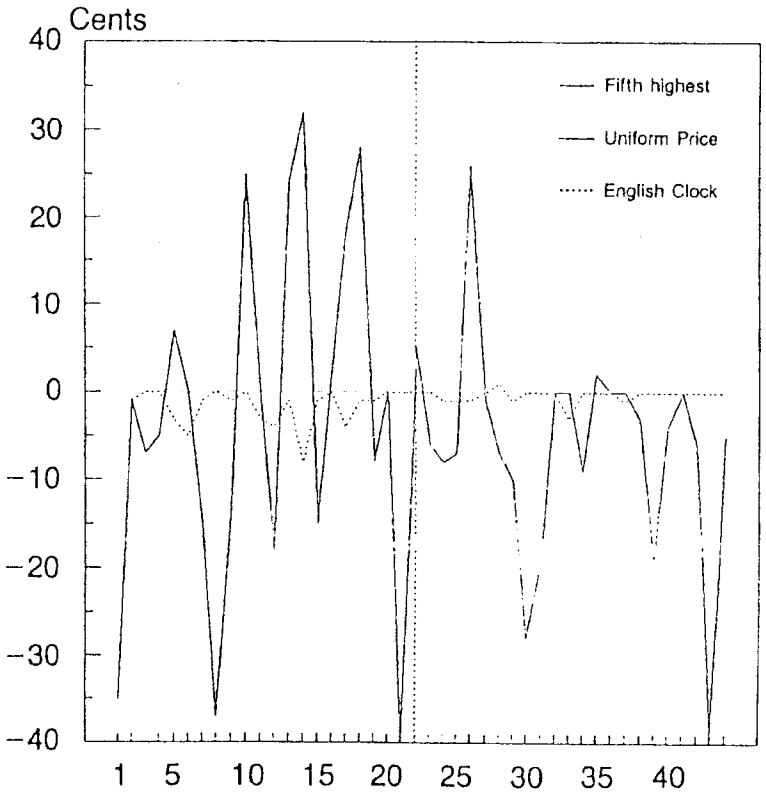


Figure 1. Graph of Price Differences for the English Clock and Uniform Price Sealed Bid Treatments

4.305). A major criticism of the sealed bid form of "call market" organization by practitioners who use it is its "black box" or blind bidding feature. No information is available to the bidders until the auction ends (Schwartz 1988, pp. 442–446), and this increases both price and transactions uncertainty. Figure 1 corroborates this criticism, and demonstrates the equilibrating power of a mechanism with one form of information feedback—the English Clock auction.

IV. VICKREY MATCHING AUCTION

In our search for more efficient institutions, we were motivated to examine two auctions described in Vickrey's work. One of Vickrey's proposals is a simultaneous nondiscriminatory auction, Vickrey (1976), which we call the Vickrey Matching Auction. In this auction there is only one bid on the floor for all units. In Vickrey's words,

> A Pareto optimal procedure is available, however, if all the items are auctioned simultaneously, with up to n ($n = 4$ in our case) bids permitted at any given level, the rule being that once n bids have been made equal to the highest bid, any further bid must be higher than this. Within the 'jitter' determined by the minimum acceptable bid increment, this assures optimal results, . . .

Implementation

We implemented Vickrey's auction as follows. On the blackboard at the front of the room is a row of four boxes. To the left of the row of boxes is a space for the bid. At the beginning of the auction all boxes are blank and the bid is set to zero. Buyers who wish to buy at the bid price are asked to raise their ID cards. Buyers IDs are entered in the boxes from left to right.

Once four buyers are found the auctioneer calls for a new bid. Whoever makes the new bid must be willing to buy at that price. When a new bid is made the auctioneer erases the buyer ID's currently in the boxes and places the ID of the new bidder in the first box. Additional buyers willing to buy are then asked to raise their cards. Once three additional buyers are found the auctioneer again asks for a new bid.

The auction continues until less than four buyers are willing to buy at the bid price or no new bids are forthcoming. When the auction ends, the buyers who have expressed a willingness to buy, at the most recent bid, each win a unit and pay the bid price.

Model and Predictions

The Vickrey Matching Auction is similar to the English Clock Auction except the suggested price P^t is determined from subject bids by the following rule.

$$B^t_\tau = \{i : b_i(t,\tau) > P^{t-1} \quad \text{if } \tau = 1 \text{ and}$$
$$b_i(t,\tau) \geq P^t \quad \text{if } \tau = 2, \ldots, m\}$$

Notice, Matching auctions are composed of rounds which consist of a bid followed by matches, meaning, a match is a willingness to buy at the bid which opened the round. Within a round time is indexed by τ. At $\tau = 1$ the opening bid is made and at $\tau = 2, \ldots, m$, matches are made.

Next we choose j randomly from B^t_τ using a uniform distribution. We can update P^t, C^t by;

$P^t = b_j(t,1)$
$C^t_\tau = j$.

The first time $B^t_\tau = \emptyset$ the auction is over. Call t, $\hat{\tau}$ the stopping time then

$$P = \begin{cases} P^t & \text{if } \hat{\tau} > 1 \\ P^{t-1} & \text{if } \hat{\tau} = 1, \end{cases}$$

and

$$C = \begin{cases} C^t & \text{if } \hat{\tau} > 1 \\ C^{t-1} & \text{if } \hat{\tau} = 1. \end{cases}$$

Individual i's payoff is given by $\pi_i(P, C)$.

Let $h_i(t,\tau)$ be i's history of the auction up to (t,τ) where $h_i(t,\tau) = (b_i(1,1), \ldots, b_i(t,\tau); P^1, \ldots, P^t; C^1, \ldots, C^t)$ then a pure strategy for player i is a mapping $s_i(\cdot)$ defined by;

$$b_i(t+1,1) = s_i(h_i(t,m)) \quad \text{for } \tau = 1$$
$$b_i(t,\tau) = s_i(h_i(t,\tau-1)) \quad \text{for } \tau > 1.$$

We can now show that each player i has a dominant strategy that only depends on P^t and P^{t-1} at any time t. In words each buyer will submit an opening ($\tau = 1$) bid slightly above the last rounds bid (i.e., P^{t-1}) as long as their new bid is below value. At $\tau > 1$ each buyer will match the current bid whenever their value is below the current bid and they are not yet in the current contract. Formally, the strategy is defined by

If $\tau = 1$ then,
(i) $P^{t-1} < v_i \rightarrow b_i(t,1) = P^{t-1} + \epsilon$
where $\epsilon > 0$ is as small as possible.
(ii) $P^{t-1} \geq v_i \rightarrow b_i(t,1) = 0$.

If $\tau > 1$ then,
(iii) $i \in C^t$ or $P^t > v_i \rightarrow b_i(t,\tau) = 0$
$i \notin C^t$ and $P^t \leq v_i \rightarrow b_i(t,\tau) = P^t$.

To show that this is a dominant strategy we note that,

$$P < v_i \rightarrow i \in C$$

and

$$P \geq v_i \rightarrow i \notin C.$$

Furthermore, since $\epsilon > 0$ is chosen as small as possible this strategy guarantees that no matter what strategies are played by the $n - 1$ other players, that is, call this s^{-i}, that

$$P(s_i^*, s^{-i}) \leq P(s_i, s^{-i})$$

for all s_i. In fact, there exists strategies by the other players s^{-i} which always let i set price, that is, for $j \neq i$

$$b_j(t, 1) = 0 \text{ for all } t.$$

and in this case,

$$P(s_i^*, s^{-i}) < P(s_i, s^{-i})$$

for all $s_i \neq s_i^*$.

Vickrey Matching Data

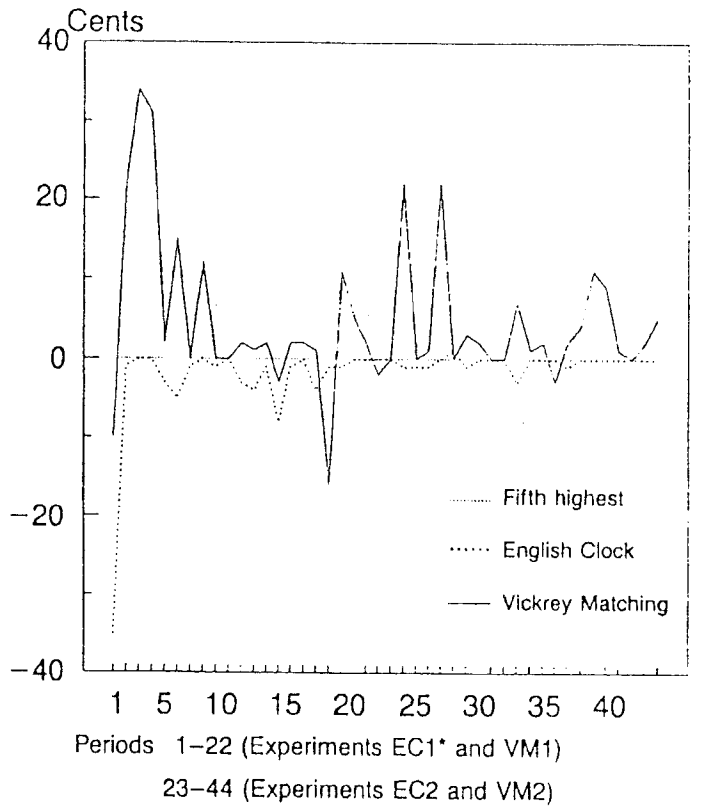
As seen in Figure 2, the Vickrey Matching institution prices higher than both the theoretical predictions and the baseline institution. When we look at the detailed bidding data we observe that the second to last bid is almost always below fifth highest value while the last bid is above. In general, subjects use too large a bid increment. In several cases this resulted in less than four units being sold. For example, in period 24 (i.e., period 2 in VM2) the sequence of bids was 0, 1, 80, 100. At 100 subjects 8 and 9 are the only two who can profitably match. In fact, subject 8 (with a value of 202) made the bid of 100.

V. THE FULL MATCHING AUCTION

When we ran the Vickrey Matching Auction we found that prices were higher than predicted, and in general, subjects were raising their bids by too large an amount. When a high value subject raises the suggested price p^t by too much all four units may not trade. Because this happened a few times in our experiment we thought we could improve overall efficiency by guaranteeing that four units will trade: Our modified auction is called the Full Matching Auction.

Implementation

This institution uses two rows of boxes (four in each row). A standing bid of zero is placed next to one of the rows making it the standing row. Buyers are

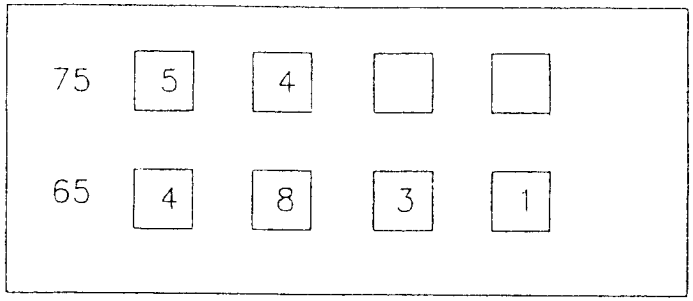


Note: *Each experiment used a new group of subjects, and subjects values were replicated accross experiments.

Figure 2. Graph of Price Differences for the English Clock and Vickrey Matching Treatments*

asked to raise their ID cards if they are willing to buy at the standing bid price. Buyers IDs are entered from left to right. Once four buyers are found the standing bid and row are renamed the floor bid and row and a higher standing bid is requested. If a new bid is forthcoming it is placed to the left of the remaining blank row of boxes and the new bidder's ID is place in the left most box. Buyers are asked to raise their ID cards if they are willing to buy at the standing bid price.

Once all four ID boxes in the standing row are filled, the standing row is renamed the floor row and the data in the previous floor row is erased (leaving us with four blank boxes to make up the new standing row). A new standing bid is



1. The standing bid is 75.
2. The floor bid is 65.
3. The tentative contract is buyers 5,4,3,1 buy at 65.
4. Notice that 4 was bumped by 5 making 4 eligible to bid. Buyer 4 then rematched at 75.

Figure 3. Example Full Matching Board

solicited. The auction continues in this fashion until no new bids are forthcoming or there are an insufficient number of buyers willing to pay the standing bid price.

At any point in time we define the tentative market contract as follows: The market price is always the floor bid. The tentative buyers are all the players with IDs in the standing row together with those players in the floor row who are to the right of the last player to match the standing bid. For example, in Figure 3, the active bid is 75 made by buyer 5 and matched by buyer 4. The old bid is 65 made by buyer 4 and matched by buyers 8, 3, and 1 respectively. The current contract is at a market price of 65 and buyers 5, 4, 3, and 1 each buy a unit. When the auction ends the tentative market contract is executed.

Model and Predictions

The Full Matching Auction is different from the Vickrey Matching Auction in how P and C are calculated. In this auction price is always determined by the opening bid in the previous round while the current contract includes the current round bidders and the bidders from the last round who have not been displaced in the current round. Formally, in Full Matching,

$$P = P^{t-1}$$

and

$$C = (C_1^t, \ldots, C_{\tau-1}^t, C_\tau^{t-1}, \ldots, C_m^{t-1}).$$

In the middle of the first experiment we realized that this implementation could have bad incentive properties which can be seen as follows. There is an essentially unique subgame perfect Nash Equilibrium for this auction where subjects play the following pure strategies. In round 1 at $\tau = 1$ everyone submits a bid of ∞ (or $V^{max} + \epsilon$). At $\tau = 2, \ldots, m-1$ everyone submits a matching bid. Notice at $\tau = m$ no one matches because this would result in a loss. Formally, for $\tau = 1$,

$$P^{t-1} < v_i \rightarrow b_i(t, 1) > V^{max}$$
$$P^{t-1} \geq v_i \rightarrow b_i(t, 1) = 0,$$

and for $\tau > 1$,

$$P^{t-1} \leq v_i \leq V^{max} < P^t \text{ and } \tau < m \rightarrow b_i(t, \tau) = P^t$$
$$P^{t-1} \leq v_i \leq V^{max} < P^t \text{ and } \tau = m \rightarrow b_i(t, \tau) = 0.$$
$$P^{t-1} > v_i \rightarrow b_i(t, \tau) = 0.$$

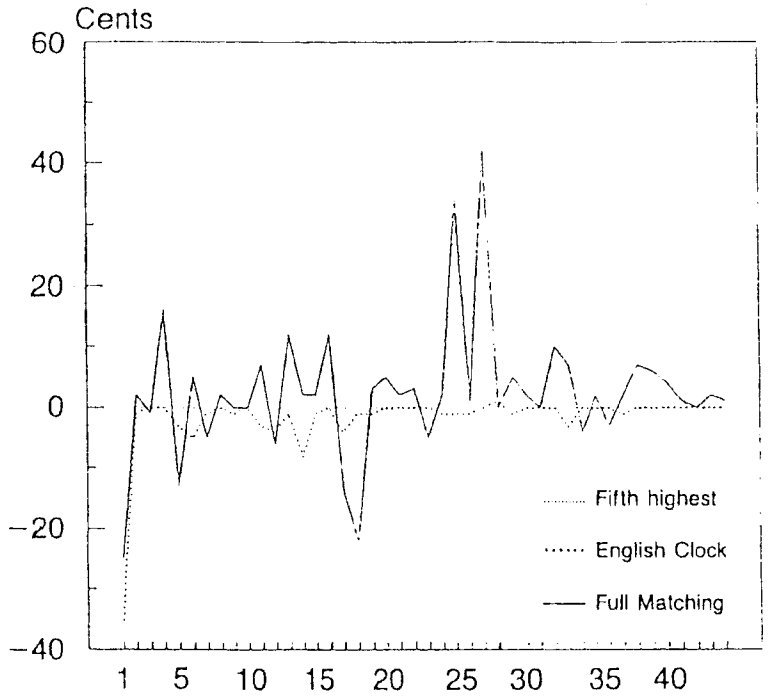
We can use backward induction to show that this is essentially unique. If at any point t, $P^t > V^{max}$ then at $\tau = m$ everyone will choose $b_i(t,m) = 0$ since not doing so will result in a loss; that is, $P > V^{max}$ so $v_i - P < 0$. But given this result and $P^0 = 0$, it is clear that at $t = 1$ and $\tau = m - 1$ that everyone should choose $b_i(1,\tau) > V_{max}$ since $B_m^1 = \emptyset$ and the market price $P = P^0 = 0$.

Note that this is not a dominant strategy since there are strategies which will result in $B_m^1 \neq \emptyset$.

Full Matching Data

The Full Matching (Figure 4) data does not conform to the zero price prediction. In fact, this data exhibits a pattern of positive price differences similar to the Vickrey Matching data. In the individual bidding data buyers tended to use the improvement rule to bid the price up until the fifth highest bidder dropped out.

A larger number of experiments now document the difficulty in attaining Nash Equilibria that require backward induction. The problem is not with the ability to backward induce in what are usually trivial problems (such as Full Matching), but rather with the formation of a consensus among the players that everyone else is employing this technique. For example, Harrison and McCabe (1988) are able to get the Stahl-Rubenstein bargaining outcome when subjects play subgames that are not usually reached in normal play but provide important feedback to make the correct backward induction. Similarly, in the full Matching design subjects could develop zero price expectations if they were at first put into a one unit full matching auction.



Note: Each experiment used a new group of subjects, and subjects values were replicated accross experiments.

Figure 4. Graph of Price Differences for the English Clock and Full Matching Treatments

VI. THE VICKREY BACKTRACKING AUCTION

Because Full Matching was found to have bad theoretical properties, we were still interested in finding an institution that could correct for observed overbidding in the Vickrey Matching Experiments. The Vickrey Backtracking Auction allows the suggested price to backtrack in a range that maintains the dominant strategy incentives of the Vickrey Matching Auction.

Implementation

This institution uses two rows of boxes (four in each row) and is identical to the Full Matching auction except the following rule change was introduced. Instead of matching the standing bid a buyer can choose to submit a new standing bid. The new standing bid must be less than or equal to the old initial standing bid (i.e., the bid that started the standing row) and higher than the floor bid (to guarantee price improvement.) The new bid replaces the old standing bid. The new bidder's ID is placed in the left most blank buyer box in the standing row. Once the four buyer boxes in the standing row are filled, the standing row is made the floor row and a new initial standing bid is solicited.

Model and Predictions

The Vickrey Backtracking Auction is similar to the Full Matching Auction except P^t becomes P^t_τ and is determined by

$$P^t_\tau = b_j\,(t, \tau).$$

Remember, j is chosen randomly from B^t_τ, which is now defined as;

$$B^t_\tau = \{\, i : b_i\,(t, 1) > P^{t-1}_m \text{ and } P^t_\tau - 1 \geq b_i\,(t, \tau) > P^{t-1}_m \text{ for } \tau > 1 \,\}.$$

Price P and allocations C are determined by the same rules as Full Matching.

The Following strategy to simply bid ϵ above the bid price as long as the new bid is below value is a dominant strategy for this institution. Formally,

$$P^{t-1}_m < v_i \rightarrow b_i\,(t, \tau) = P^{t-1}_m + \epsilon$$
$$P^{t-1}_m \geq v_i \rightarrow b_i\,(t, \tau) = 0.$$

Notice if some player now plays such that $P^t_\tau = V^{\max} + \epsilon$ and $P^{t-1}_m < v_i$, then i can always enter at $P^{t-1}_m + \epsilon$. Furthermore, if the auction ends a $P < v_i$ then i must be in C.

Vickrey Backtracking Data

Because this institution allows bids to be lowered whenever they rise above market clearing levels, then an excessive early bid need not cause the auction to stop prematurely. As seen in Figure 5, with the exception of a few significant blips, this institution tracks the theoretical price predictions fairly well. In periods 3 and 4 subject number 1 made the price determining bid above, or equal to, his value. In fact, subject 1 often bid above value. It is possible that 1 believed (usually correctly) that other players would reduce his bid via backtracking.

A more important problem with this institution is that it takes a long time

Table 3. Bidding Data for Period 2 of VB2

		Buyers									
SEQ Number	*BID*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	100	X					X	O			X
2	102			O			X	X			X
3	130	O									
4	103		O				X	X			
5	105		X	X				X			O
6	110	X					O				X
7	106	O									
8	110	X					X	O			X
9	112		O				X	X			X
10	120	O									
11	113		O				X	X			
12	114	X	X					X			O
13	118	X					O				X
14	115		O								
15	120						X	O			X
16	117	O									

Notes: O indicates buyers made bid.
X indicates a match at this bid.
Market price is 117.
Winners are 1, 6, 7, 10.

(relative to the other institutions) to finish a period. In Table 3 we present the data for period 25 (period 3 of VB2). Ultimately subjects 1, 6, 7 and 10 get a unit and pay 117. The outcome is 100% efficient and 1 cent below fifth highest value. Notice that the bid backtracked 5 times in this period. Subject 2 (fifth highest value) was responsible for 4 of the backtracking bids. In general, backtracking was widely used, causing Vickrey Backtracking to run almost twice as long (on average) as Vickrey Matching periods.

VII. THE SIMULTANEOUS BIDDING AUCTION

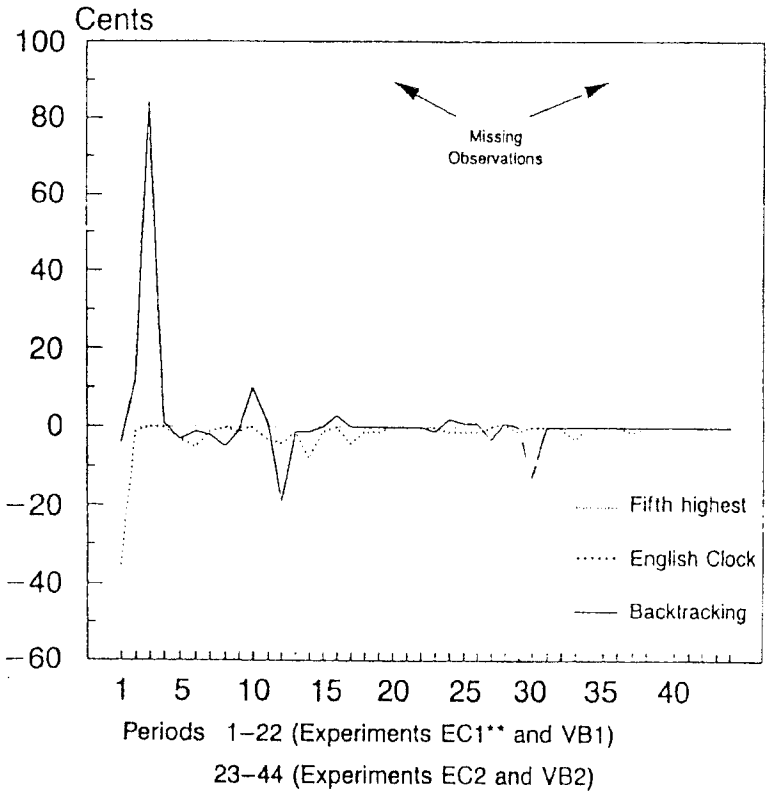
Vickrey (1961) proposes an alternative auction to his (1976) proposal, which we will call the Simultaneous Bid Auction. In Vickrey's words

> In simultaneous auctioning the m ($m = 4$ in our case) items can be put up simultaneously, and each bidder permitted to raise his bid even when this does not make his bid the highest. When a point is reached such that no bidder wishes to raise his bid further the items are awarded to the m highest bids. . . . Bidders with the top m values then secure the article at a uniform price equal to the $(m + 1)$st value; the result is again Pareto-optimal.

Notice this auction does not impose a uniform price but predicts a uniform price as a dominant strategy outcome.

Implementation

Our implementation of this auction uses one row of four boxes (one for each unit to be sold). The auction starts with a minimum standing bid for each unit in each box. If a buyer's bid beats the lowest standing bid for a unit then the buyer's ID is placed below that box and the buyer's bid becomes the new standing bid.



Notes: Vickrey Backtracking is missing observations for periods 18–22 and 32–44.
Each experiment used a new group of subjects, and subjects values were replicated across experiments.

Figure 5. Graph of Price Differences for the English Clock and Vickrey Backtracking Treatments

The auction is over when no new bids are forthcoming. At this time the four buyers with standing bids each win a unit and pay their respective standing bids. In general, this institutions leads to price discrimination.

Model and Prediction

In the Simultaneous Bidding Auction we can denote $b^t = (b_1^t, \ldots, b_n^t)$, the vector of bids at t and $P^t = (P_1^t, \ldots, P_m^t)$, the standing bids at t and $C^t = (C_1^t, \ldots, C_m^5)$, the standing bidders at t. Define the minimum standing bid at time t as $\hat{P}^t$, that is

$$\hat{P}^t = \min \{P_K^t\}_{K=1}^m \text{ and}$$
$$B^{t+1} = \{i : b_i^{t+1} > \hat{P}^t\}.$$

Finally, let j be a random choice from B^{t+1} and let h satisfy $\hat{P}^t = P_h^t$ then simultaneous bidding is defined by:

$$\hat{P}^0 = 0,$$
$$\forall\, K \neq h,\ P_K^{t+1} = P_K^t \text{ and } C_K^{t+1} = C_K^t,$$
$$P_h^{t+1} = b_j^{t+1} \text{ and } C_h^{t+1} = j$$

where the auction ends at $t > 0$ such that $B^t = \emptyset$. Then

$$P = P^t \text{ and } C = C^t$$

and payoffs are given by

$$\pi_i(C, P) = \begin{cases} v_i - P_j \text{ if } i = C_j \text{ for some } j \\ 0 \quad \text{otherwise} \end{cases}$$

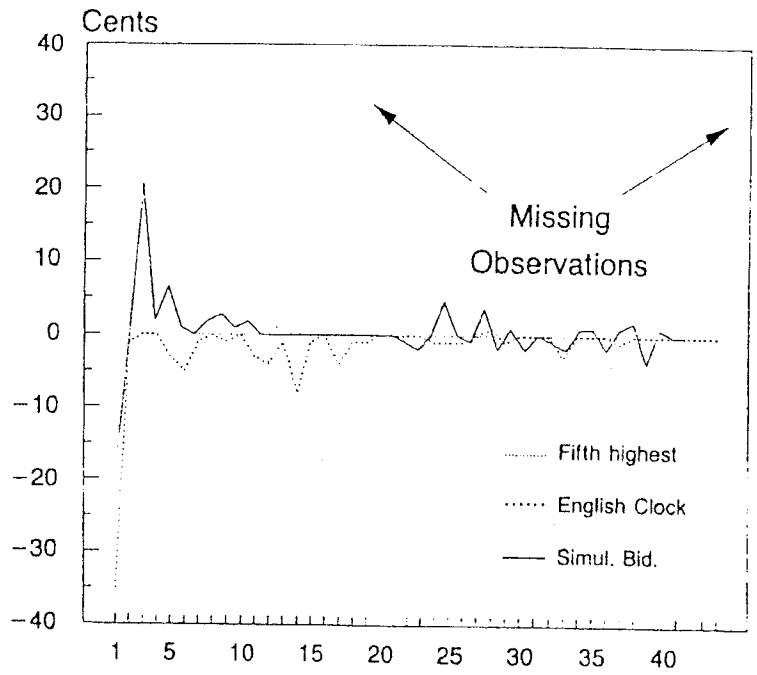
If buyer i is currently not a winner, then i has a dominant strategy to bid slightly above the lowest current winning bid (i.e., $\hat{P}^t$). Formally, this strategy is,

$$P^t < v_i \text{ and } i \notin C^t \rightarrow b_i^t = \hat{P}^t + \epsilon$$
$$\text{otherwise } b_i^t = 0.$$

It is easy to see that P_j will equal the $m + 1$ highest value for all j and that the m highest value buyers will be in C.

Simultaneous Bidding Data

In Figure 6 we plot the difference between the average successful bid price and the fifth highest value. Table 4 presents the detailed price data for this institution. In the first experiment (SB1) we were able to finish 11 periods. Again, some subjects used larger bid increments than the minimum bid increment as can be seen by the spread in prices. Note these excessive bids only stop trading in one unit, not the whole auction.



Note: Simultaneous Bidding is missing observations for periods 12–22 and 43–44.

Figure 6. Graph of Price Differences for Simultaneous Bidding and English Clock Treatments

In SB2 we started the minimum bid at 75 (thus only 2 units traded in period 27, that is, period 5 in SB2). We also made the minimum bid increment 5 cents. By doing this we were able to complete 20 periods.

Looking at the detailed bidding data in SB2 we see that this is essentially a slowed down Vickrey Matching institution; bidders produce prices that are within one bid increment of being uniform. In Table 5 we present the detail for period 38 (period 16 of SB2). Notice that each quartet of bids was submitted at a uniform price. As a buyer gets bumped he or she goes to the next available unit at the lowest bid. This continues until no one else gets bumped.

Table 4. Price Data for SB Auctions

	SB1				SB2			
Period	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
1	115	130	111	111	135	135	130	135
2	80	76	79	76	75	80	75	75
3	120	120	160	150	115	115	115	120
4	95	95	100	95	100	100	95	100
5	60	65	55	80	80	75	—	—
6	85	85	85	90	85	85	80	85
7	95	100	110	95	105	105	105	100
8	150	150	150	150	145	150	145	145
9	130	130	150	140	135	135	135	140
10	110	110	110	115	110	105	105	110
11	95	95	100	90	95	90	90	95
12					95	100	100	95
13					95	95	100	95
14					80	80	80	75
15					125	120	125	125
16					95	95	100	95
17					155	155	155	155
18					105	105	100	100
19					110	110	110	110
20					120	120	120	125
21								
22								

VIII. FIRST REJECTED SIMULTANEOUS BID

The Simultaneous Bidding Auction exhibit more price dispersion between unit prices than predicted by the theory. This observation led us to try two uniform price versions of the simultaneous bid auction.

The First Rejected Auction

This auction is similar to the Simultaneous Bidding Auction, except five boxes are used. Buyers can improve on the standing bid in any box. The auction ends when no one wishes to improve and the buyers with the four highest standing bids each win a unit and pay the fifth highest standing bid.

Model and Predictions

We can introduce the first rejected price F^t, which satisfies the following rules:

Table 5. Period 15 of SB2

	Units			
SEQ Number	*1*	*2*	*3*	*4*
1	10–75			
2		3–75		
3			2–75	
4				9–75
5	6–80			
6			10–80	
7		2–80		
8				3–80
9	9–85			
10		6–85		
11				2–85
12			3–85	
13			10–90	
14				3–90
15		2–90		
16	6–90			
17	9–95			
18		6–95		
19				2–95
20			3–95	
21			10–100	

$$F^0 = 0$$
$$F^{t+1} = \hat{P}^t$$

where h satisfies $\hat{P}^t = P_h^t$ as explained in the Simultaneous Bidding Auction in Section 7. Now price simply becomes $P_j = F^t$ for $j = 1, \ldots, m$. Otherwise, this auction is identical to the Simultaneous Bidding Auction.

The following strategy (similar to the Full Matching Auction strategy) results in a Nash equilibrium

$$\hat{P}^t < v_i \text{ and } i \notin C^t \rightarrow b_i^{t+1} > V^{\max}$$
Otherwise $b_i^{t+1} = 0$.

In equilibrium, the first m players are randomly chosen to be in the contract and each pay zero. In the first period each player bid greater than $V^{\max}$, thus assuring that no buyer has an incentive to bid a first rejected bid.

Note that this strategy is dangerous because any buyer can bid just below the lowest winning bid and force all the winners to pay this price. An alternative Nash Equilibrium with more stable properties is for everyone to bid value; that is,

$$\hat{P}^t < v_i \text{ and } i \notin C^t \rightarrow b_i^{t+1} > V_i$$
Otherwise $b_i^{t+1} = 0$.

To see that this is Nash note that the price is fifth highest value. For any of the losers to enter they must bid higher than the fourth highest value, which makes the fourth highest value the price. But this would result in a loss for any buyer with a value less than the fourth highest.

First Rejected Data

In Figure 7 we plot price differences for the First Rejected Auction. Price tend to move in a 10 cent band below the theoretical equilibrium. In looking at the detail data we note that in most cases the fifth highest players stopped bidding somewhere below their values. In period 3 we observe an example of overbidding (player 9 bid 185!). However, occurrences of overbidding were much rarer than the overbidding observed in the uniform price sealed bid auctions.

IX. LAST ACCEPTED SIMULTANEOUS BID

Given the possibility for bad equilibria in the First Rejected Version of the Simultaneous Bid Auction we also looked at a Last Accepted Version.

The Last Accepted Auction

This auction is the same as the Simultaneous Bidding Auction except when the auction ends buyers with standing bids each win a unit and pay the fourth highest standing bid.

Model and Predictions

This model is identical to the simultaneous bid auction except

$$P_K = \hat{P}^t \text{ for } K = 1, \ldots, m.$$

The dominant strategy defined for the Simultaneous Bidding Auction (section 7) is also a dominant strategy for this case.

Last Accepted Data

Prices in the last accepted auction (Figure 8), track the theoretical prediction quite well. We observe much larger bid increments than the SB auctions and more variation (although small) relative to the English Clock baseline.

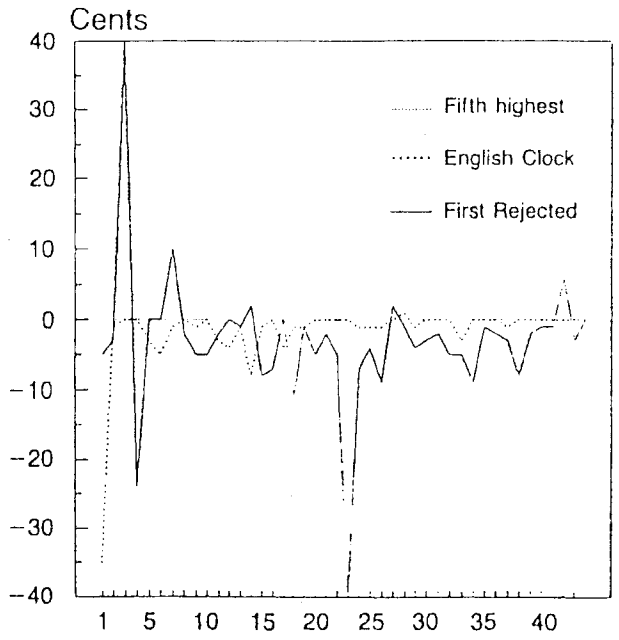


Figure 7. Graph of Price Differences for First Rejected and English Clock Treatments

X. EFFICIENCY DATA

We measure efficiency as actual surplus (the sum of the winners) resale values divided by maximum surplus (the sum of the four highest resale values.) In Table 6 we provide summary measures of efficiency. Note that we have not penalized implementations which failed to go the full 44 periods, although it is clear from our earlier discussion that we view this as a problem.

Below the summary statistics we provide *t*-tests for the null hypothesis that mean efficiency between a baseline institution (EC and UP) is the same as mean efficiency in one of our implementations. We treat each auction period as a data

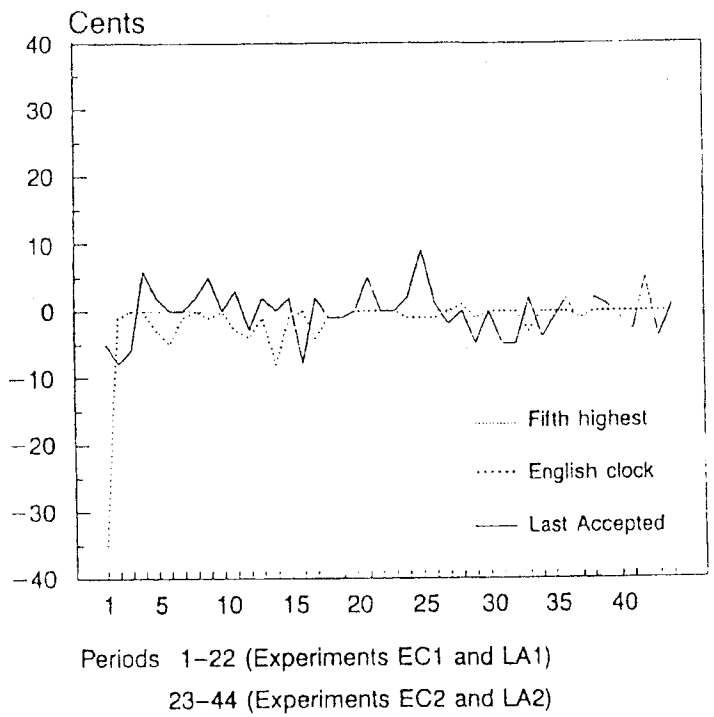


Figure 8. Graph of Price Differences for Last Accepted and English Clock Treatments

point in computing our *t*s. Although values are randomized the same individuals played for 22 periods. Thus, our data may not be independent across observations. Such an issue can only be resolved with greater replication using more subject variation. From these tests we see that FM, VB, and LA are significantly better, SB is marginally better, and VM and FR are as good as the sealed bid auctions (UP). In the second SB experiment we had 100% efficiency in every period but 5, where the minimum bid of 75 cut out 2 potential winners. Thus we feel if minimum bids and bid increments are correctly chosen then SB will significantly outperform UP.

Finally, note that the English clock is significantly better than VM and FR, marginally better than FM and VB and indeterminate with respect to SB and LA.

Table 6. Summary Measures of Efficiency

	EC	*UP*	*VM*	*FM*	*VB*	*SB*	*FR*	*LA*	
Statistics									
Avg.	99.99	97.36	97.77	99.36	99.88	99.03	98.5	99.84	
Std.	.149	4.023	7.233	2.45	.319	4.782	5.038	.767	
N	44	44	44	44	26	31	44	44	
***t*-Tests**									
EC		4.317	2.026	1.676	1.504	1.106	1.948	1.189	*t*-value
		.0001	.049	.1011	.142	.2776	.058	.2407	probability
UP	−4.317		−.329	−2.816	−4.133	−1.637	−1.173	−4.017	
	.0001		.7435	.0063	.0002	.1060	.2441	.0002	

Notes: EC = English Clock, UP = Uniform Price Sealed Bid } Baselines
VM = Vickrey Matching
FM = Full Matching
VB = Vickrey Backtracking
SB = Simultaneous Bidding
FR = First Rejected
LA = Last Accepted

XI. CONCLUSIONS AND EXTENSIONS

Conclusions

From our study of different implementations of multiple unit versions of the English Auction the following conclusions can be made. First, because all the progressive auctions performed better than the uniform price, sealed bid auctions, our experiments support the conjecture that the feedback of market information during an auction improves efficiency. This result is even stronger when we realize that uniform-price, sealed-bid auctions give subjects a dominant strategy (in our environment) to reveal and thus in theory should be 100% efficient.

Our second conclusion is that the English Clock is our best implementation and likely to find acceptance in the field. This auction gives participants feedback during the auction while controlling the pace of the auction (thus not allowing subjects to impose time preferences). The English clock also produces consistent pricing and very high efficiency. Finally, because of its simplicity, the English Clock can accommodate programmed (via computerized agents) bidding.

Our third conclusion is that our auctions show an important form of value added that can be provided by an auctioneer. Clearly, the auctioneer can control the pace of the auction. The auctioneer can also control backtracking by implementing a dutch sequence of prices when he or she overshoots. We chose not to implement a Dutch clock in Vickrey Backtracking because we have studied this implementation in McCabe, Rassenti, and Smith (1988). Furthermore, in a Simultaneous Bidding model we found that the choice of starting bid and bid increment (choices made by an auctioneer) were important.

Our fourth conclusion is that our Full Matching auction provides further experimental evidence that inexperienced subjects do not behave according to Nash Equilibrium predictions, which require subjects to use backward induction that take into account the behavior of other subjects. Although the experiments ran well, this implementation shows the value of constructing a full rationality model. With the right type of experience, as outlined in our discussion in Section 5, we conjecture that subjects will try to manipulate this institution, causing it to behave badly.

Extensions

There are several ways to extend the experimental research in this paper. First, the class of environments should be extended to include buyers who desire multiple units and may try to manipulate price by underrevealing quantity.

A second important extension is to provide a model of progressive auctions that take into account the time preferences of participants. In our implementations Vickrey Matching gives priority to those participants with high discount rates, while Vickrey Backtracking gives priority to those participants with low discount rates. The simultaneous Bidding Auctions (including first rejected and last accepted) give priority to the 4 or 5 participants with the highest discount rates, thus placing these auctions in the middle in terms of priority.

If we assume that subjects exhibit impatience, that is, a preference for ending sooner, we can explain the Vickrey Matching Data. Impatience arises naturally as an expression of the opportunity cost of time. In the laboratory an opportunity cost of time arises if a subject believes that he will get in more periods if each period is finished faster or that he will get out of the experiment sooner by finishing each period faster.

A simple model of impatience is as follows. Each individual $i = 1, \ldots, I$ has a utility function,

$$U_i(x_i,p,\tau) = x_i(V_i - p) - a_i\tau_i, \tag{1}$$

where: $x_i \in \{0,1\}$ and $x_i = 1$ when i wins a unit;
$p \in R+$ is the market price;
$\tau \in R+$ is the amount of time the auction takes;
$V_i \in R+$ is the value of owning the unit; and
a_i is the opportunity cost per unit of time.

Let $b_i(p_t,m_t,t)$: $R_+ \times M \times R_+ \rightarrow R_+$ be is bidding strategy defined as the bid i makes at time t when the market price is p_t and m_t buyers have matched. Let $b = (b_1, \ldots, b_I)$ be a strategy I-tuple. Given b, for each i we can computer $x_i(b)$, $p(b)$, and $\tau(b)$. Thus, we can write i's payoff function as;

$$W_i(b) = W_i(b_i,b^i) = U_i(x_i(b), p(b), \tau(b)), \tag{2}$$

where: b^i is the I-1 tuple of bid functions of the other I-1 subjects.

If S is the total number of units up for sale and $a_i = 0$, then is dominant strategy is:

$$b_i(p_t, m_t, t) = \begin{cases} p_t & \text{if } m_t < S \\ p_t + \text{minc} & \text{if } m_t = S \end{cases} \tag{3}$$

where: minc is the minimum bid increment. Note that this strategy guarantees that agent i's payoff will be as large as possible.

However, if $a_i > 0$ then for any pair x_i, p subject i is best off with the smallest possible τ. There is no longer a dominant strategy equilibrium. Now a player must trade off the cost of a higher potential ending price (because he or she used too large a bid increment) against the increased value of keeping τ small. Note that any single player can end the auction quickly by making a high enough bid. Thus the impatient players with the high values of a_i may impose misallocations on the other bidders.

It may seem at first that our Backtracking Data is inconsistent with the model of impatience which explains the Vickrey Matching data. In particular, when given the opportunity to waste time backtracking, subjects do! Actually, the

impatience model does explain the backtracking data without contradiction. Thus, in Vickrey Matching, bidders with a high a_i can impose their time preferences on others by stopping the auction early, while in Vickrey Backtracking those with a low a_i can impose their time preferences by backtracking prices to keep the auction going.

Experiments can be run that try to control for impatience through induced values. We chose to control impatience through the institution because this is what must be done in the field. However, trying to control for impatience in the lab can add greater insight into the effects and causes of the opportunity cost of time. For example, we conjecture that the following method of inducing values would improve the Vickrey Matching auction in the direction of Vickrey's predictions: require a new improving bid every five seconds, pay the winners as before, and in addition pay all participants a penny for every five seconds the auction runs. Clearly subjects would have an incentive to use the minimum bid increment in order to get the participation wage.

APPENDIX I: INSTRUCTIONS FOR FULL MATCHING

Instructions

This is an experiment in the economics of market decision making. The instructions are simple, and if you follow them carefully, you may earn a considerable amount of money, which will be paid to you in cash. Figures are in the back of the instructions.

Overview

In this experiment, we will conduct an oral auction consisting of 22 auction periods. At the beginning of each auction period, four units of a commodity of value will be offered for sale. Each buyer will be given a resale value (described below) for a unit bought in the current period. Each buyer can purchase at most one unit in each auction period.

On the board in the back of the room you will notice two rows of blank boxes. This is where the auction will take place. The boxes are used to hold the suggested contract holders in the auction. You can become a contract holder by either matching a bid or making a bid as explained below. A bid is an amount that a buyer has offered in order to purchase a unit of the good. At the end of the auction period (what determines the end is explained below) the suggested contract holders become final contract holders and are each sold a unit of the good at the current market price (explained below).

At the beginning of each period your terminals will provide you with your resale value for a unit of the good. If you get to buy a unit of the good in that period, we will pay you (in U.S. dollars) three times the difference between your resale value and the price you paid. At the end of each period your terminal will tell you your profit that period (this number is not multiplied by 3). The information on your terminal is private information. Do not look at anyone else's screen, and do not discuss this information with anyone else. During the experiment we will enforce a no talking rule.

Terminology

At the blackboard you see two rows of four boxes each. To the left of each row is a number (initially zero) that indicates a bid. Inside the boxes will be the buyer numbers of buyers who indicated they would buy at the market price indicated by the bid to the left. When a row has all four boxes filled with buyer numbers the bid to the left is called the floor bid. If a row has at least one box filled and one or more boxes unfilled the bid on that row is called the standing bid. The market price will always be the floor bid. Any buyer with a buyer number in the standing bid row is in the suggested contract (i.e., gets to buy at the floor price). If a buyer has his or her buyer number in the floor bid row and there is no buyer number in the adjacent standing bid row, then that buyer is also in the suggested contract. See Figure AI.1 for an example.

Bidding

At the beginning of the auction period we will open the floor to bidding. The floor price and standing price are both set to zero. At this point you can signal to bid by raising your ID card above your head. The auctioneer will recognize bidders by calling out their number. Once recognized you can make a bid that consists of either a new standing bid or an offer to match the current standing bid. A new standing bid must improve on the floor bid. Furthermore, if a standing bid already exists, a new standing bid must be less than the old standing bid. If you bid is valid it will replace the current standing bid and your buyer number will be entered in the left most blank buyer box across from the standing bid. If you simply want to match the standing bid say "I match the standing bid." In this case the standing bid stays the same and your buyer number is entered in the left most blank buyer box across from the standing bid. For example, if Figure AI.2(a) marked before, the current standing bid is 75, the floor bid is still zero and two buyers (7 and 4) are in at the standing bid. Now buyer 10 bids 60. Figure AI.2(b) indicates the new board. Now buyers (7, 4, and 10) are in at 60. Notice, if you are a buyer and your number is in one of the buyer boxes, the price you will pay will always be less than or equal to the price at which you entered the box. Thus four entered at 75 but the standing price has dropped to 60.

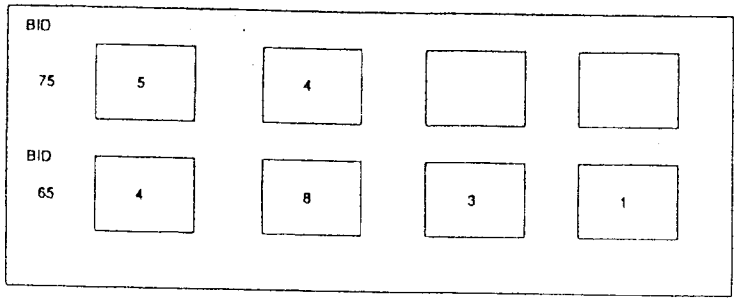
Once the standing bid row boxes are all filled the standing bid becomes the new floor bid. The old floor bid is erased together with all the buyer numbers in the old floor bid buyer boxes. The floor is then opened to a new standing bid greater than the floor bid. Note that this bid must be a standing bid and not a match because the standing bid must first be determined before matching bids can take place.

Outcomes

Once no further bids are forthcoming the market will be closed. At this point the suggested contract on the blackboard becomes the final contract and each buyer in the final contract will be sold one unit of the good at a market price equal to the floor price. Figure AI.3 gives some examples of final contracts.

Profit

Your profits will be displayed on your computer terminal. See Figure AI.4 for an example. If you did not buy a unit in a period then your profit for that period will be zero.

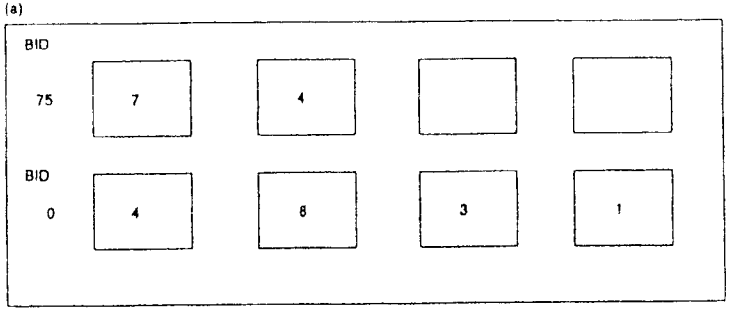


1. The standing bid is 75.
2. The floor bid is 65.
3. The suggested contract is buyers 5,4,3,1, get to buy at 65.
4. Suggested contract holders may not bid.
5. Notice that 4 was bumped by 5 making 4 eligible to bid.
   Buyer 4 then reentered the suggested contract at the standing bid. Now 4 cannot bid.

Figure AI.1. Terminology

Before

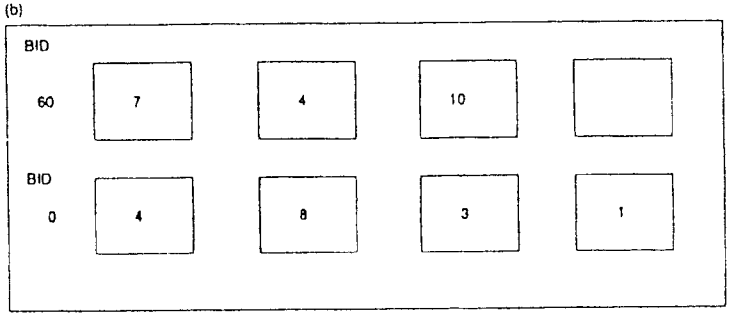
(a)



1. The Standing bid is 75.
2. The floor bid is 0.
3. The suggested contract is buyers 7,4,3,1, get to buy at 0.
4. Suggested contract holders may not bid.
5. Notice that 4 was bumped by 7 making 4 eligible to bid.
   Buyer 4 then reentered and suggested contract at the standing bid. Now 4 cannot bid.

After

(b)

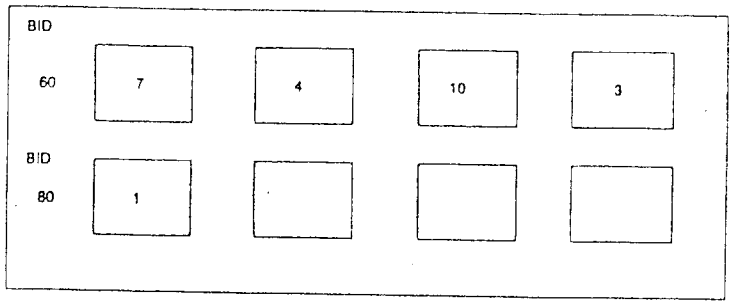


1. The standing bid is 60.
2. The floor bid is 0.
3. The suggested contract is buyers 7, 4,10,1, get to buy at 0.
4. Suggested contract holders may not bid.

Figure AI.2. Bidding

(a)

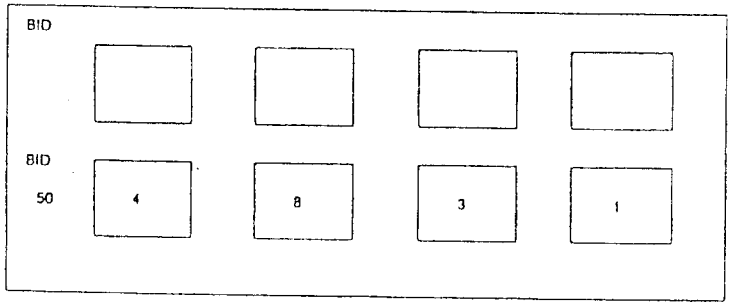
Market Price with Standing Buyer



1. The standing bid is 80.
2. The floor bid is 60.
3. The final contract is buyers 1,4,10,3 buy at the market price of 60. Buyer 1 is the standing buyer and has bumped Buyer 7 from the final contract.

(b)

Market Price with Only Floor Buyers



1. The standing bid is none.
2. The floor bid is 50.
3. The final contract is buyers 4, 8, 3, 1 buy at the market price of 50. Note that all buyers are floor buyers.

Figure AI.3. Final Contracts

Buyer #0

Period	*Value*	*Price*	*Buy*	*Profit*
1	1.90	1.10	YES	0.80
2	1.60	.80	NO	0.00
3	.15	1.25	NO	0.00
4	.75	.85	YES	−0.10
5	2.05	1.75	YES	0.30
6	.30	.90	NO	0.00
.	.			
.	.			
.	.			

1. Note Buyer 0 bought in period 1, 4, 5.
2. In period 4 buyer 0 made a loss since he or she paid a price of .85 when it was worth only .75 cents. This loss will be subtracted from buyer 0's profits.
3. Remember that total profit will be multiplied by 3 to give you your total earnings at the end of the experiment.
4. Notice in period 2 buyer 0 did not buy even though the lowest price of .80 is far below his or her value of 1.60. Thus, buyer 0 gave up earnings of $3 \times (1.60 - .80) = 3 \times (.80) = \$2.40$.

Figure AI.4. Sample Record Sheet

If you bought a unit, your profit is the difference between your resale value and the market price. At the end of the experiment we will pay you three times the amount of profit you have earned.

APPENDIX II: INSTRUCTIONS FOR SIMULTANEOUS BIDDING

Instructions

This is an experiment in the economics of market decision making. The instructions are simple, and if you follow them carefully, you may earn a considerable amount of money, which will be paid to you in cash. Figures are in the back of the instructions.

Overview

In this experiment, we will conduct an oral auction consisting of 22 auction periods. At the beginning of each auction period, four units of a commodity of value will be offered for sale. The four units are identical to one another. Each buyer will be given a resale value (described below) for a unit bought in the current period. Each buyer can purchase at most one unit in each auction.

On the board in the back of the room you will notice a row of blank buyer boxes. This is where the auction will take place. The boxes are used to hold the bids of the buyers in the auction. A bid is an amount that a buyer is willing to pay in order to purchase a unit of the

good. At the end of the auction period (what determines the end is explained below), the four buyers whose bids are currently in the boxes are each sold a unit of the good at the price at which they bid.

At the beginning of each period your terminals will provide you with your resale value for a unit of the good. If you get to buy a unit of the good in that period, we will pay you (in U.S. dollars) three times the difference between your resale value and the price you paid. At the end of each period your terminal will tell you your profit that period (this number is not multiplied by 3). The information on your terminal is private information. Do not look at anyone else's screen, and do not discuss this information with anyone else. During the experiment we will enforce a no talking rule.

Terminology

On the blackboard you see a row of four boxes. Each box will represent one unit of the good which is for sale. Inside each box will be the number of the buyer who has bid the most for that unit, followed by a comma and the bid he has made.

Bidding

At the beginning of the auction period we will open the floor to bidding. The initial buyer and price for each unit is set to 0,0. At this point you can signal to bid by raising your ID card above your head. The auctioneer will recognize bidders by calling out their number. Once recognized you can make a bid by specifying which unit you wish to bid on

Buyer #0

Period	*Value*	*Price*	*Buy*	*Profit*
1	1.90	1.10	YES	0.80
2	1.60	.80	NO	0.00
3	.15	1.25	NO	0.00
4	.75	.85	YES	−0.10
5	2.05	1.75	YES	0.30
6	.30	.90	NO	0.00
.	.			
.	.			
.	.			

1. Note Buyer 0 bought in period 1, 4, 5.
2. In period 4 buyer 0 made a loss since he or she paid a price of .85 when it was worth only .75 cents. This loss will be subtracted from buyer 0's profits.
3. Remember that total profit will be multiplied by 3 to give you your total earnings at the end of the experiment.
4. Notice in period 2 buyer 0 did not buy even though the lowest price of .80 is far below his or her value of 1.60. Thus, buyer 0 gave up earnings of $3 \times (1.60 - .80) = 3 \times (.80) = \$2.40$.

Figure AII.1. Sample Record Sheet

and what bid you wish to make. A new bid must improve on the existing bid for that unit. No buyer will be allowed to have his number in more than one box at a time.

Outcomes

Once no further bids are forthcoming the market will be closed. At this point the four buyers with their numbers in the boxes become the purchasers of the four units of the good, and each will be sold his unit of the good at a price equal to his bid.

Profit

Your profits will be displayed on your computer terminal. See Figure AII.1 for an example. If you did not buy a unit in a period then your profit for that period will be zero and the price recorded will be the lowest price paid by any purchaser. If you bought a unit, your profit is the difference between the resale value and the price you paid which is recorded. At the end of the experiment we will pay you three times the amount of profit you have earned.

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APPENDIX C

Attached is a copy of the Decision in Appeal No. 2002-2245 (decided March 31, 2003 in Applicant's application SN 09/476877).

537420

Paper No. 20

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte LAWRENCE M. AUSUBEL

Appeal No. 2002-2245
Application No. 09/476,877

HEARD: MARCH 20, 2003

Before BARRETT, GROSS, and LEVY, Administrative Patent Judges.
LEVY, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 53, 54, 57, 60, 61, 64-67, 71-75, 78, 79, and 81-86. Claims 55, 56, 58, 59, 62, 63, 68-70, 76, 77, and 80 have been objected to.

BACKGROUND

Appellant's invention relates to a computer implemented method and apparatus for auctions. An understanding of the invention can be derived from a reading of exemplary claim 53, which is reproduced as follows:

53. A computer implemented auction system for television licenses or associated derivative rights comprising:

a) an auctioneer's system and at least two user systems, the auctioneer's system communicatively coupled to user systems;

b) said user systems including:

(b1) means for receiving messages from the auctioneer's system and for displaying those messages;

(b2) means for receiving bid related information from users, said information including bids for television licenses or associated derivative rights; and

(b3) means for transmitting bid information to the auctioneer's system; and

c) said auctioneer's system including:

(c1) means for generating and transmitting messages to user systems, said messages a non-final message indicating that an will continue and a final message indicating that an auction has terminated;

(c2) means for receiving bid information from user systems;

(c3) and decision means responsive to the bid information received from the user systems for determining whether an auction should continue or terminate, said decision means including:

> (c31) means to initiate the generation of a non-final message to at least one user system in response to a determination to continue an auction; and
>
> (c32) means to initiate the generation of a final message to at least one user system in response to a determination to terminate an auction.

The prior art reference of record relied upon by the examiner in rejecting the appealed claims is:

> ONSALE: "ONSALE Brings Thrill of Auctions and Bargain Hunting Online; Unique Internet retail service debuts with week-long charity auction for The Computer Museum in Boston", Dialog File 610; Accession No. 0489267 BW0022, Business Wire (1997).

Claims 53, 54, 57, 60, 61, 64-67, 71-75, 78, 79, and 81-86 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over ONSALE. Rather than reiterate the conflicting viewpoints advanced by the examiner and appellant regarding the above-noted rejection, we make reference to the examiner's answer (Paper No. 13, mailed December 28, 2001), final rejection (Paper No. 8,

mailed April 12, 2001, and first office action[1] (Paper No. 4, mailed June 8, 2000) for the examiner's complete reasoning in support of the rejection, and to appellant's brief (Paper No. 12, filed October 12, 2001) and reply brief (Paper No. 14, filed February 14, 2002) for appellant's arguments thereagainst. Only those arguments actually made by appellant have been considered in this decision. Arguments which appellant could have made but chose not to make in the brief have not been considered. See 37 CFR 1.192(a).

OPINION

In reaching our decision in this appeal, we have carefully considered the subject matter on appeal, the rejection advanced by the examiner, and the evidence of obviousness relied upon by the examiner as support for the rejection. We have, likewise, reviewed and taken into consideration, in reaching our decision, appellant's arguments set forth in the briefs along with the examiner's rationale in support of the rejection and arguments in rebuttal set forth in the examiner's answer.

---

[1] We observe that the examiner's answer refers to the final rejection for the rejection of the claims. The final rejection, in turn, refers to the previous office action for the rejection of the claims. Although the examiner should not refer back to more than a single previous office action (see MPEP § 1208, Eigth Edition, (August 2001)), because we can understand the rejection of the claims advanced by the examiner, we decline to remand the application for correction of this matter.

It is our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would not have suggested to one of ordinary skill in the art the invention as set forth in claims 53, 54, 57, 60, 61, 64-67, 71-75, 78, 79, and 81-86. Accordingly, we reverse, for the reasons set forth by appellant, and add the following comments.

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the examiner to establish a factual basis to support the legal conclusion of obviousness. See In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one having ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434,

1438 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985); ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a prima facie case of obviousness. Note In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). If that burden is met, the burden then shifts to the applicant to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole. See id.; In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986); In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); and In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976).

Six of the claims before us on appeal are independent claims. Three of these independent claims (53, 67, and 81) are drawn to a computer implemented system for conducting an auction of television licenses or associated derivative rights. The remaining three independent claims (60, 74, and 84) are drawn to a computer implemented method of conducting an auction of television licenses or associated derivative rights. Appellant asserts (brief, page 2) that the invention is for auctions of

multiple dissimilar objects. An example (id.) is an auction for broadcast licenses which are inherently dissimilar because different licenses cover different territory, broadcast channels, or both.

The examiner's position (Office action, mailed June 8, 2000, pages 3-5) is that with respect to claim 53, the only difference between ONSALE and the claimed auction is the reference to television licenses or associated derivative rights. According to the examiner, this kind of data does not affect the functionality of the system as they "are merely different types of data that cannot be accorded patentable differences," and that these items, things, or objects "would have been obvious to the skilled artisan when gleaning from the ONSALE system." As to the other five independent claims, the examiner refers to the rejection of claim 53. In appellant's response (Paper No. 7, filed November 8, 2000, page 3) appellant asserted ONSALE does not disclose "decision means responsive to the bid information . . . for determining whether an auction should continue or terminate." The examiner's response (Paper No. 8, mailed April 12, 2001, page 2) is that ONSALE clearly teaches that in a standard auction, items are sold to the highest bidder after a

fixed period of time. Appellant responds (brief, page 8) that there is no disclosure in the reference of a "decision means" as recited in claim 53, nor the step of "determining . . . in response to the bid information received from users, whether the auction should continue or terminate" as recited in independent claim 60. In addition, appellant notes (id.) that both the decision means and the determining step are responsive to bid information received.

The examiner cites In re Bozek, 163 USPQ 545 (CCPA 1969) (final rejection, page 3) for the proposition that

> [h]aving established that this knowledge was in the art, the examiner could then properly rely, as put forth by the solicitor, on a conclusion of obviousness "from **common knowledge and common sense** of the person of ordinary skill in the art without any specific hint or suggestion in a particular reference." (examiner's emphasis)

Appellant argues (brief, page 9) that Bozek is inapt because Bozek deals with the question of considering together the teachings of two different references, whereas in the instant case, only one reference has been applied against the claims. In addition, appellant (id.) cites In re Zurko, 258 F.3d 1379, 1385, 59 USPQ2d 1693, 1697 (Fed. Cir. 2001) for the proposition that:

> We cannot accept these finding by the Board. This assessment of basic knowledge or common sense was not based on any evidence in the record, and, therefore, lacked substantial evidence support. As an administrative tribunal, the Board clearly has expertise in the subject matter over which it exercises jurisdiction. This expertise may provide sufficient support for conclusions as to peripheral issues. With respect to core factual findings in a determination of patentability, however, the Board simply cannot reach conclusions based on its own understanding or experience - or on its assessment of what would be basic knowledge or common sense.

With respect to independent claims 67 and 81, appellant asserts (brief, page 10) that these claims also require "means for determining" based upon the bids or signals, "the television licenses or associated derivative rights to be assigned." Appellant argues (id.) that the claims make clear that the system is a computer implemented auction, or is itself a computer system, and asserts that "[t]here is nothing in the reference which describes, discloses or even hints at a computer implemented system or a computer system with a mean[s] for determining as is recited in claims 67 and 81." Appellant adds that the examiner's reliance on In re Bozek, 163 USPQ 545, and "common knowledge and common sense" does not provide support to justify the rejection.

With respect to independent claims 74 and 84, appellant asserts (brief, page 11) that "[t]here is no disclosure in the reference of either a 'computer implemented' auction" or the step of "determining the licenses or other derivative rights to be assigned to bidders." Appellant argues that when appellant challenged the rejection, the examiner's response was the reference to In re Bozek and "common knowledge and common sense". Appellant adds (brief, page 12) that "[f]or all that appears in the reference, whatever determining that might take place could be based upon human judgment." The examiner responds (answer, page 6) by asserting that ending an auction is not an unexpected step because auctions usually have an end. The examiner asserts (id.) that the instant case distinguishes from In re Zurko because in Zurko, 258 F.3d at 1385, 59 USPQ2d at 1697, "necessary steps were not present in the prior art and whereby logical reasoning could not have been logically arrived at along a trusted path."

We find that ONSALE is directed to an internet retail service that is designed as a place that consumers can peruse "irresistible collectibles and close-out merchandise" (page 1). Limited quantity goods are sold in quick-action formats such as

auctions and markdowns. Customers can browse through the inventory or take a guided tour with an online personality who is an expert in a particular class of goods. Goods include "sports and rock-and-roll memorabilia, computers and electronics, last minute vacation packages, special wine collections, tickets to events and vintage watches" (page 2). Consumers can observe ONSALE's auctions and browse through markdown merchandise without going through a registration process. Merchandise is sold using three interactive formats: standard auctions, dutch auctions and markdowns. ONSALE page 2 states that:

> Initially, ONSALE's merchandise will be sold using one of three interactive formats: standard auctions, dutch auctions and markdowns. In a standard auction, an item is placed onsale for a fixed time period and sold to the highest bidder. Dutch auctions occur when a number of identical items are offered for sale at the same time period. The highest bidders purchase the available inventory at the lowest successful bidders price. ONSAL's markdown merchandise decreases in price in time intervals. Customers can buy markdown items at the current posted price, or can wait until the next time interval, which may be hours or days, when the offering price goes down.

Before placing an order or bidding on an item, customers must first fill out a simple registration form. Once registered, customers may bid and buy at will. Each auction page displays

the highest bidder's initials, city and state. ONSALE page 3 states

> Customers need not worry about overbidding on an item, as all bids are proxy bids, i.e., the actual price paid for an item is never more than one price increment above the second highest bid on the item. Additionally, customers do not have to hang out on the Web all day to ensure they are kept in the bidding process. Upon request, ONSALE will notify customers by email when their bids are no longer the highest and customers can respond by email to increase their bids.

In addition, "ONSALE adds fun and adventure to online shopping by recreating the excitement of bidding at an auction and hunting for bargains, where prices and availability vary instantly in response to demand."

From the disclosure of ONSALE, we find that ONSALE is silent as to whether an automated system or a human makes a decision as to whether to terminate or continue the auction, as required by each of the claims. ONSALE is additionally silent as to whether the decision to continue or terminate the auction is based upon bid information received from users, as required by each of the claims. Although a standard auction will end after a fixed time has passed, it is unclear as to whether the step of determining whether the auction should continue or terminate is carried out by a computer system in response to bid information received from users, or due to a human determining from a clock that the

auction needs to continue or terminate. Thus, ONSALE does not disclose determining based upon the bids or signals received, the television licenses or associated derivative rights to be assigned to the bidders, and therefore does not establish a prima facie case of obviousness of the claimed invention.

As to the examiner's reliance on In re Bozek, we find the examiner's reliance to be misplaced. Because ONSALE is essentially a press release and does not describe a number of specific details of the system, we find that as in Zurko, 258 F.3d at 1385, 59 USPQ2d at 1697, ONSALE fails to provide sufficient evidence that would necessarily lead to the conclusions reached by the examiner. See In re Gartside, 203 F.3d 1305, 1314, 53 USPQ2d 1769, 1774(Fed. Cir. 2000) (Board decision "must be justified within the four corners of the record"). The examiner bears the initial burden of establishing a prima facie case of obviousness. See In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). A prima facie case of obviousness is established by presenting evidence that would have led one of ordinary skill in the art to combine the relevant teachings of the references to arrive at the claimed invention. See In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988) and In re Lintner, 458 F.2d 1013, 1016, 173 USPQ 560,

562 (CCPA 1972). This initial burden is not met by resorting to speculation as to what would have been obvious based upon common knowledge and common sense of one of ordinary skill in the art. Instead of trying to distinguish from Zurko, the examiner's time would be better spent finding prior art that suggests the claimed invention, instead or trying to rely upon "common knowledge and common sense" in an attempt to make up for the deficiencies of ONSALE.

From all of the above, we find that the examiner has failed to establish a prima facie case of obviousness of independent claims 53, 60, 67, 74, 81 and 84. The rejection of claims 53, 54, 57, 60, 61, 64-67, 71-75, 78, 79, and 81-86 under 35 U.S.C. § 103(a) is therefore reversed.

OBSERVATIONS AND REMARKS

PTO policy dictates that an appeal conference is required for all appeals, effective for all appeals received by the Board of Patent Appeals and Interferences on or after November 1, 2000; MPEP § 1208, Eight Edition, August 2001. The record does not reflect any evidence that an appeal conference has been held. However, this was not realized until after the Oral Hearing had taken place and the decision was in the process of being drafted.

Because this case has been at the Board for a period of time in excess of one year, and appellant has already come to the PTO and argued the case before the Board, we decline to return the case to the Director of the Technology Center without a decision, as this would be unfair to appellant.

CONCLUSION

To summarize, the decision of the examiner to reject claims 53, 54, 57, 60, 61, 64-67, 71-75, 78, 79, and 81-86 under 35 U.S.C. § 103(a) is reversed.

REVERSED

LEE E. BARRETT
Administrative Patent Judge

ANITA PELLMAN GROSS
Administrative Patent Judge

STUART S. LEVY
Administrative Patent Judge

) BOARD OF PATENT APPEALS AND INTERFERENCES

ssl/vsh

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